A Study of the Maxillae with Regard to Their Blood and Lymph Supply. VIII.

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The arterial blood supply to the teeth and their adnexa in both the mandible and maxilla is supplied through branches of the internal maxillary artery. The branches are, (1) the posterior superior alveolar artery, (2) the infra-orbital, and (3) the greater palatine artery. The posterior superior alveolar artery arises in the pterygo-palatine fossa from either the internal maxillary artery, or from a branch of the latter, the infra-orbital artery. The posterior superior alveolar artery divides into a number of branches a short distance from where it arises from either of the above-named vessels. These branches are called the posterior superior alveolar arteries. They are met with on the tuberosity of the maxilla and some of them penetrate the bone, to pass to the molar teeth; others supply the maxillary sinus; still others pass directly to the gums without entering the bone.

The infra-orbital artery passes through the orbital fissure into the infra-orbital canal, and while passing through this canal, gives off the anterior superior alveolar arteries, which pass by way of more or less complete canals to supply the premolar, canine and incisor teeth.

The greater palatine artery after giving off the branch which passes into the smaller palatine opening (the anterior palatine foramen) gives off alveolar and gingival branches. These branches of the greater pala-

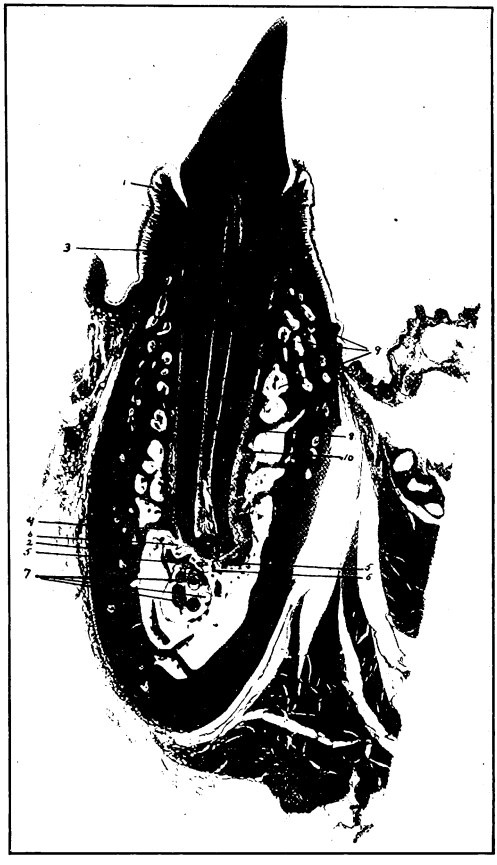


FIG. 172.

tine artery, which have recently been studied by Ducournau, complete the arterial blood supply to the incisor teeth of the maxilla.

The inferior alveolar artery (inferior dental or mandibular artery) passes through the mandibular canal and gives off dental branches (*rami dentales*) to all the teeth in the mandible. In the region of the mental foramen it gives off branches to the canine and incisor teeth, and one branch passes through the foramen to chin.

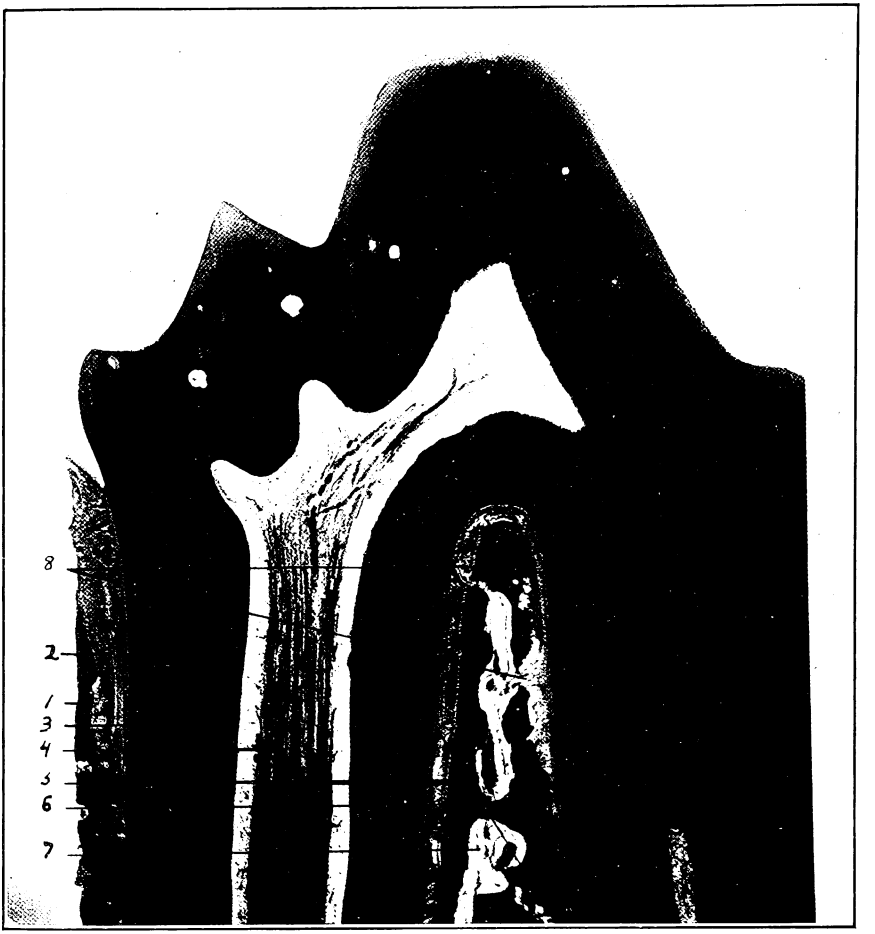


FIG. 173.

The dental branches of these arteries pass into the teeth and supply the pulps of the same; others pass to the marrow of the bone. Still other branches (*rami inter-alveolares*) between the alveoli divide and form branches (*rami perforantes gingivales*) which pass to the gums, and others (*rami perforantes alveolares*) pass inward into the alveoli for the teeth.

A particularly rich anastomosis exists between the rami dentales and the rami inter-alveolares blood vessels, so that it is possible for the blood

to circulate freely in one or the other directions. Zuckerhandl* has carefully demonstrated the distribution of the above branches.

The veins take the same course as the arteries and open into the internal pterygo-palatine venous plexus, from which the blood passes into the external jugular vein.

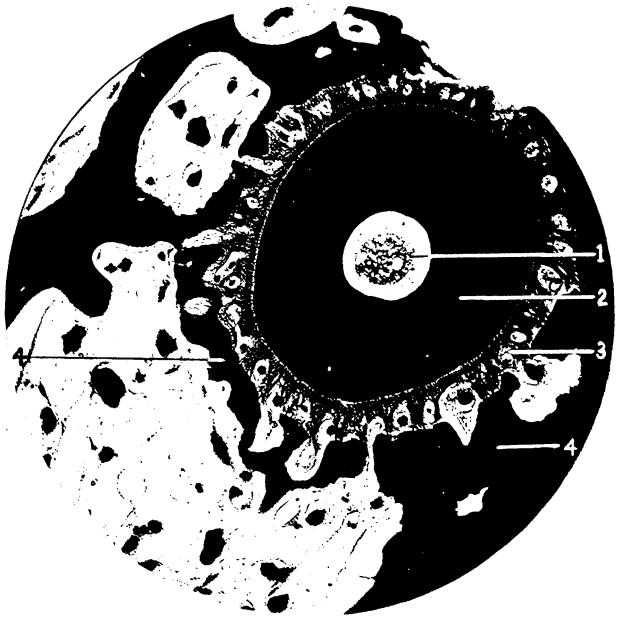


FIG. 174.

In Fig. 172 is seen a section of the mandible of a cat. The enamel was destroyed during the process of decalcification. The epithelium of the gum is at 1 with its underlying mucosa and submucosa. The papillæ of the mucosa are clearly shown. The periosteum of the jaw is seen at 2. Extending from 3 to 4 we examine the alveolar wall; in the upper two-thirds it appears very compact, while the lower third, especially at the right, shows numerous small light areas, which are foramina in the dark portion, which is the bony wall. The points marked 5 indicate the floor of the alveolus, and the light areas 6 show where the floor of the alveolus is absent.

At 7 is seen the inferior alveolar artery and vein and mandibular

* Zuckerhandl, "Anatomie der Mundhöhle mit besonderer Berücksichtsgung der Zähne." Wien, 1891.

nerve. Note the relation of these structures to the floor of the alveolus. At 8 we note the pulp; the section, unfortunately, did not pass through the apical foramen. In the alveolar process (9) we observe numerous light areas containing dark spots; the former are canals in the bone or bone marrow, and the latter are blood vessels containing blood. At 10 we see the intra-alveolar periosteum.

FIG. 175.

There is exhibited in Fig. 173 a portion of a longitudinal section of a molar tooth. At 1 is part of the wall of the alveolus. At 2 is the intra-alveolar periosteum. At 3 is shown the dentin from which enamel is lost by decalcification. The light areas in the upper part of the dentin are sections of the pulp cavity. At 4 the pulp is seen with its numerous blood vessels. At 5 is the inter-alveolar bony septum, surrounding which at 6 is seen the inter-alveolar periosteum. The light areas (7) in the bony septum contain the inter-alveolar vessels (*rami inter-alveolaris*), from which at 8 we note three *rami perforantes alveolares* passing. At 9 we see part of the other root and pulp in section.

We pass now to Fig. 174, which is a transverse section of a tooth at its middle third, showing (1) the pulp, (2) dentin, (3) intra-alveolar

periosteum, (4) wall of alveolus, which is markedly perforated, and through the perforations we could trace the blood vessels. Outside the wall of the alveolus we see the light spaces containing marrow fat, in which are the *rami inter-alveolares*. The intra-alveolar periosteum is made up mainly of white fibrous connective tissue in the form of Sharpey's fibers extending from the wall of the alveolus to the tooth. In this tissue we notice numerous blood vessels containing blood.

FIG. 176.

Our next specimen, Fig. 175, is a part of the intra-alveolar periosteum, seen in Fig. 174, more highly magnified. At (1) is seen dentin, (2) Sharpey's fibers, (3) blood vessels containing blood, and (4) the wall of the alveolus.

A longitudinal section of the upper part of the alveolar process is shown in Fig. 176. At 1 is the dentin and cementum, which, if carefully examined, shows some dentinal tubules, also Sharpey's fibers, penetrating the cementum. At 2 we have the intra-alveolar periosteum, where Sharpey's fibers are clearly seen; while at the lower part is seen a blood vessel. At 3 is the periosteum of the bone; 4 is the bone with numerous canals in transverse, oblique and longitudinal section. The

small light dots are the bone lacunæ. At 5 is a canal containing a blood vessel which passes to 6 and enters the intra-alveolar periosteum. Another branch (7, 8, 9) (we are looking through the wall of this canal and only its outline can be seen) passes to the external surface of the bone. At 7 and 8 some side branches of this canal are seen in transverse section, and at 9 a part of the canal in longitudinal section.

We introduce in Fig. 177 a more highly magnified picture of the

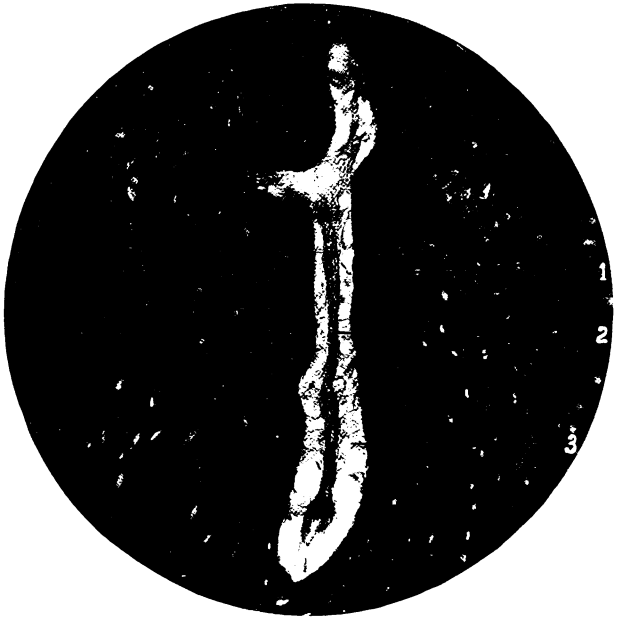


FIG. 177.

specimen in Fig. 176 at the point 9, showing an Haversian canal (1), with its vessel (2), surrounded by the perivascular canal (3). Stretching from the vessel wall to the wall of the Haversian canal are seen the trabeculæ of connective tissue. The fibrous structure of the bone is particularly well shown here, likewise the bone lacunæ, which are here seen as light areas between the fibers. The canaliculi are not shown in the picture; they could, however, be demonstrated in some parts of the specimen.

We observe in Fig. 178 a transverse section of a Haversian canal, in the center of which is a blood vessel, and from the wall of the latter

connective tissue trabeculæ pass to the wall of the canal. The space or spaces thus formed constitute the perivascular spaces or canal. Here and there in this specimen are seen the bone lacunæ.

It should be remembered that the lymph spaces in the periosteum and endosteum communicate with the pericellular lymph spaces in the canaliculi and lacunæ of the bone, and that the lymph circulates through this tissue, bathing the bone cells in the lacunæ and their cytoplasmic

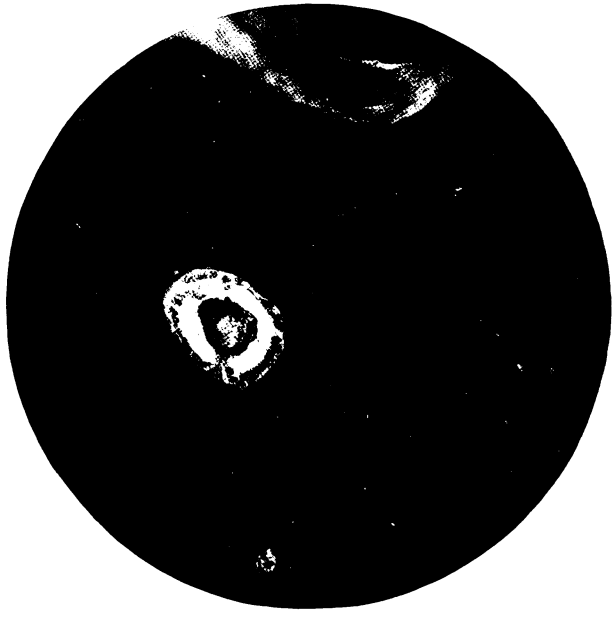


FIG. 178.

processes in the canaliculi. The lymph probably flows in the direction of the Haversian systems, into the perivascular canals or lymph spaces which surround the blood vessels in the Haversian canals. (See Fig. 176 at 9; Fig. 177, 1, 2 and 3, and Fig. 178.) In each of these pictures you will see a central vessel surrounded by a zone; across this zone fine trabeculæ of connective tissue pass and the wall of the artery or vein sometimes both, is covered with endothelium, and the wall of the Haversian canal is lined with the same. This so-called perivascular canal is a part of the lymph vascular system.

You see, according to Fig. 179, a section of dentin and pulp with Tomes's fibers entering the dentinal canaliculi. At 1 is seen the pulp;

at 2 the odontoblasts; at 3 the processes of 2 enter the dentin 4. This section was obtained from a partially developed tooth.

We observe in Fig. 180 a transverse section of the dental pulp; at 1 we see an artery containing blood. The middle coat is particularly well shown, while the external coat seems to merge with the tissue of the pulp. The arteries, even large ones, seem to have a poorly developed *tunica extima*. At 2 we see a vein, and at 3 a large capillary in

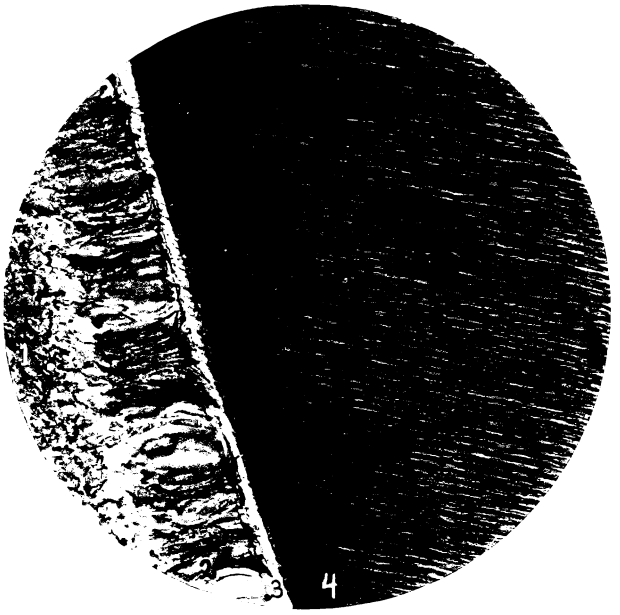


FIG. 179.

transverse section. In the latter the endothelial wall is clearly shown. Both 2 and 3 contain blood.

A capillary plexus (Lepkowski*), with oblong meshes, is seen in the pulp immediately beneath the layer of odontoblasts. We view a part of this plexus in Fig. 181. At 1 is shown an arteriole in transverse section, and at 2 a vein. Part of the capillary plexus with their thin walls is clearly seen. Some of the vessels contain erythrocytes.

The lymph supply to the gums and teeth, according to Schweitzer, is the following. The *tunica submucosa* of the gums contains a very

* Lepkowski, "The distribution of the blood-vessels in the teeth of man." *Anat. Hefte*, 1901.

delicate plexus of lymph capillaries which open into two sets of larger collecting vessels, one on the external, the other on the internal surface of the gums. The external lymphatic vessels pass to larger ones which run along the cheek and finally end in the submaxillary ganglia. The internal collecting set of lymph vessels for the mandible pass to vessels which penetrate the mylohyoid muscle, and also end in the submaxillary ganglia. The internal collecting branches of the maxilla pass to the

FIG. 180.

lymphatics of the hard and soft palate, which in turn pass by larger vessels to the walls of the pharynx and end in the jugular ganglia.

Schweitzer* has recently demonstrated the presence of lymphatics in the pulp of the tooth, not only in the fully developed state, but during the course of development. He has succeeded in injecting the lymph capillaries of the pulp, and has traced the lymphatic vessels through the root canal of the tooth. In the maxilla the lymphatic vessels, from the roots of the teeth, pass to larger vessels, which leave the bone through the infra-orbital canal. Some of these vessels end in the submaxillary

* Schweitzer, "Die Lymph gefässe des Zahnfleisches und der Zähne Archiv für micr. Anat.," 1907.

ganglia. In the mandible the lymphatic vessels of the root of the teeth pass to the lymphatic vessels in the mandibular canal. The lymphatics in the mandibular canal could not be traced to any lymph ganglion.

Our next specimen, Fig. 182, shows a section of the pulp (1), dentin (2) with the dentinal canaliculi, cementum (3), and the intra-alveolar periosteum (4). The fibers of Sharpey of this latter structure are well shown entering and in the cementum. The specimen was stained

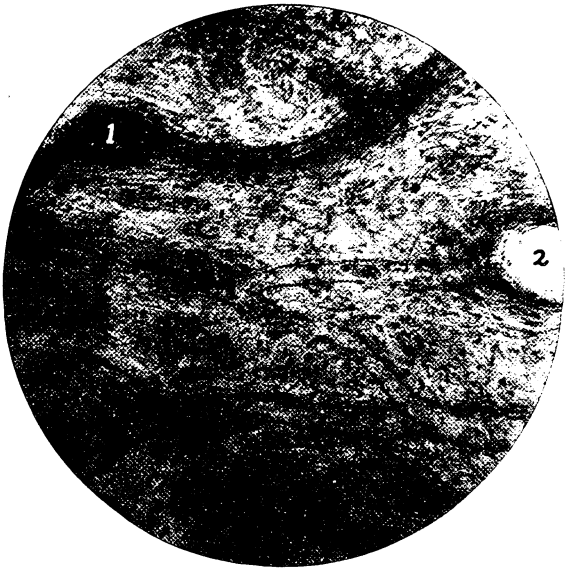


FIG. 181.

with picric acid-fuchsin (Van Giesen) stain, in which the dentin, cementum and Sharpey's fibers of the intra-alveolar periosteum appeared red, while the greater part of the pulp, the contents of the dentinal canaliculi, the contents of the lacunæ and canaliculi of the cementum and the blood vessels, cells, spaces, etc., between the Sharpey's fibers in the intra-alveolar periosteum appeared yellow.

The picric acid of this stain colors the cells yellow, *whereas the intercellular substance is stained red,* nevertheless elastic tissue is stained yellow with it, as is also the medullary sheath of a nerve, but the medullary sheath is looked upon by many as a cell or a product of the axon, and is protoplasm and not intercellular substance, therefore, we should expect it to be stained yellow. All that is light in Fig. 182 was stained yellow; all the dark places stained red; continuity by light places is

maintained from the pulp to the intra-alveolar periosteum, and the light places contained cells, processes of cells and lymph.

In Fig. 110 (Article IV) we view the wall of the pulp cavity, looking into the dentinal canaliculi. In Fig. 112, in the same article, we examine a transverse section of dentin. In both these specimens Neumann's sheath is absent. (See Article IV.) If Neumann's sheath is a harder more resistance dentin, and was a connective tissue, it should

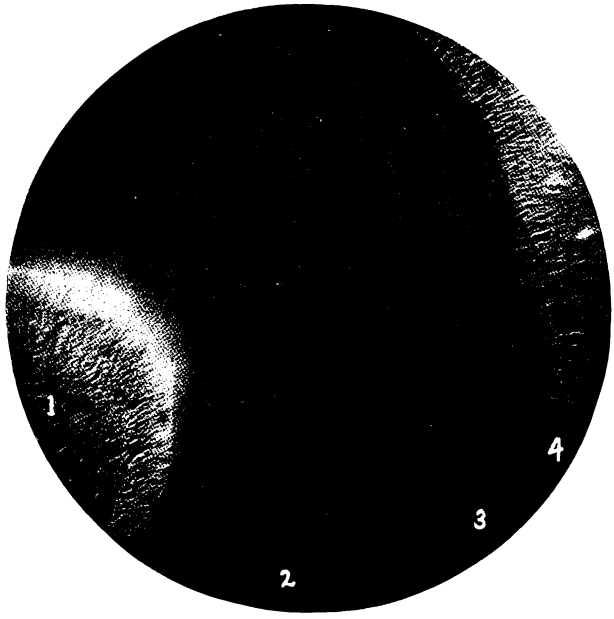


FIG. 182.

stain red with Van Giesen's stain, this it does not do. What we take to be Neumann's sheath, as described by Neumann, Kölliker and Waldeyer, is the light area surrounding a black dot, as seen in the transverse sections of dentinal tubules demonstrated in Fig. 183 at 1, and in Fig. 184 throughout the specimen. Waldeyer states, "In sections made from fresh teeth, examined with high powers (500-1,000), it is not difficult to recognize, especially in the central section of the course of the tubules, which are of considerably larger diameter, the pale homogeneous dentinal fiber. The lining of the tubules (dentinal sheaths) can only be seen in cross section, when they appear as delicate yellowish rings, in the interior of which the transverse section of the dentinal fiber is perceptible in the form of a minute dark spot."

The dentin stained red with picric acid-fuchsin and the contents of the tube yellow, yet there was a distinct difference between the central part of the yellow contents of the tube and the part surrounding it, between it and the tube wall. This central part we take to be the fiber, for by altering the focus and light it appeared as a dark spot. The yellow zone surrounding the fiber is Neumann's sheath. It may be, the fiber refracts

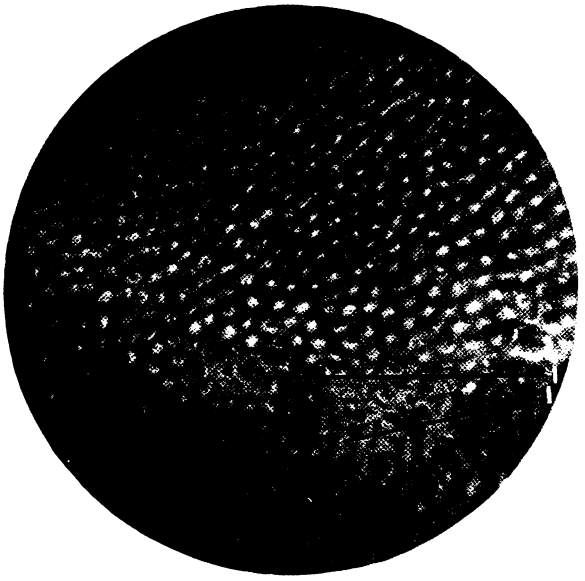


FIG. 183.

light in a way different from that of the surrounding sheath, and hence appear as a black dot, just as the direction of the fibers in bone determine the lamellæ as alternate dark and light lines. (See Fig. 10, article I.)

We can obtain a similar microchemical reaction between this stain and a medulated nerve. In Fig. 152 (article VI) we find near the center of the specimen a section of a small nerve trunk, in which you will see a number of black dots surrounded by a light area which remind one, as far as the staining is concerned, of the contents of a dentinal tubule.

The nerve trunk shows a number of small yellow areas stained by the picric acid, each surrounded by connective tissue (endoneurium) stained red by the fuchsin. In the yellow part we can differentiate the central part, the nerve fiber or axon, as a dark dot, from the surrounding

yellow medullary substance by proper focusing and adjusting the light. In the case of dentin the connective tissue (dentin) stains red with the fuchsin and the contents of the canal, fiber and sheath, like the axon and sheath of the nerve stain yellow. It must, however, be remembered that elastic tissue stains yellow with the Van Giesen stain and that possibly Neumann's sheath is an elastic structure, as some have said it was. If Neumann's sheath is dentin, it should stain as dentin does. This it does

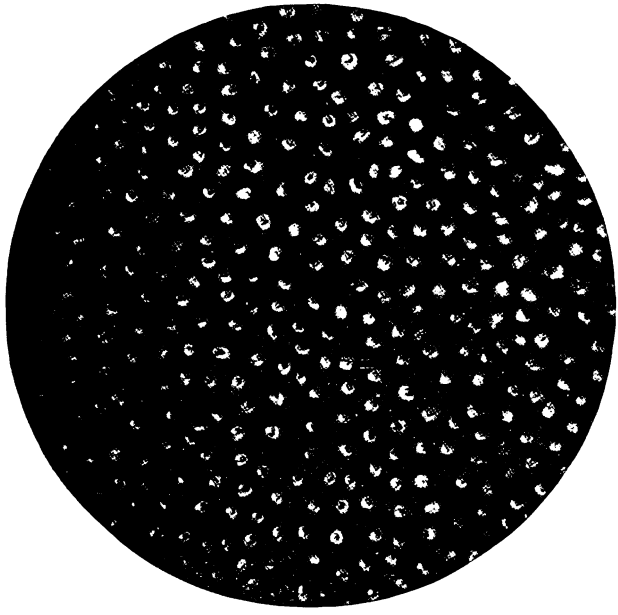


FIG. 184.

not do. If it is a more resistent and harder dentin we should find it in old and dried specimens. We can not find Neumann's sheath in dried specimens. (See Figs. 107, 108, 109, 110, 112, article IV.) If we compare Figs. 183 and 184 with Figs. 110, 111 and 112 (article IV) our point will be clear. Could not the light halo (Neumann's sheath) surrounding the dark dots in Figs. 183 and 184 be coagulated lymph in the dentinal tubules?

We see material in the lacunæ and canaliculi of bone and cementum which reacts to Van Giesen's stain in exactly the same manner, and sections of the granular layer of Tomes show contents reacting to this stain in the same way.

It is well known that the dentinal sheaths may remain after destruction of the dentin by boiling in strong acids or alkalies, and constitute the only indestructible residue of the tooth. In the same way by the action of concentrated acids on bone, we can obtain a preparation showing merely the canal system, the whole intercellular substance is dissolved, excepting a thin layer lining the cavities. Does this substance which lines the tubules of bone and dentin contain elastin? Some maintain that Neumann's sheath is elastic tissue. Elastin which comes from elastic tissue, wherever the latter exists, according to Gamgee, is "soluble in boiling solutions of caustic potash, in cold concentrated sulfuric acid, and in concentrated nitric acid."

The lacunæ and canaliculi of bone are thought of as filled with lymph plasma which circulates through them and bathes the bone cells and their processes. In the same manner should we look upon the lymph as circulating through the lacunæ and canaliculi of the cementum, to the spaces in the granular layer of Tomes, to the dentinal canaliculi and the interglobular spaces in the dentin. For the interglobular spaces can be injected with pigment, and each one should be looked upon as a kind of lymph lagoon, somewhat like the dorsal lymph sac of the frog. It will be evident on examination that the interglobular spaces are formed chiefly in the crown of the tooth beneath the enamel, and to some extent on the sides in the upper third, in places where a circulation of lymph can not be so easily maintained. In all parts of the tooth, excepting the crown, the flow of lymph is possibly from pulp to intra-alveolar periosteum, or vice versa, by the system of canals in the tooth. This is not so in the crown of the tooth, hence the greater development of interglobular spaces in this locality and on the upper part of the sides of the tooth where fewer lacunæ are found in the cementum.

When the pulp of a tooth has been destroyed the tooth is nourished by the lymph which flows from the intra-alveolar periosteum into the cementum by way of its lacunæ and canaliculi; then into the granular layer of Tomes, and finally into the canaliculi of the dentin. The above also explains the possibility of the reimplantation of teeth.

In the dentin beneath the floor of the pulp cavity (see Fig. 115, article IV) we see the dentinal canaliculi end in the center of the mass by forming loops, or a number of them enter a more or less large space. Numerous side, anastomosing branches are given off along the course of these tubules. By this maze of canals and numerous spaces the irrigation of the central part of this tissue is effected, which would probably suffer, as would the region under the enamel, for lack of a free circulation of lymph.

Not infrequently in the cementum, and sometimes in the dentin, do we meet with canals (Haversian canals) which carry blood vessels into both these structures, and thereby there is a closer connection between the blood and the lymph in these tissues. Examples of such canals are seen in Figs. 119 and 120 (Article IV), and Figs. 126, 127, 128, 129, 130 (Article V).

De Sarran* has described vessels passing through the cement and dentin from the intra-alveolar periosteum.

Résumé.

1. The blood supply to the pulp of the tooth is by way of the *rami dentales,* but a very free anastomosis exists between these vessels and the *rami inter-alveolares.*

2. Haversian canals do penetrate the cementum and dentin in perfectly normal teeth. De Sarran has described vessels passing from the intra-alveolar periosteum through the cementum and dentin.

3. The lymph flows through the lacunæ and canaliculi in the cementum, the spaces in Tomes granular layer, the dentinal canaliculi and interglobular spaces, and carries nutrition for the tissue where blood vessels never or rarely penetrate.

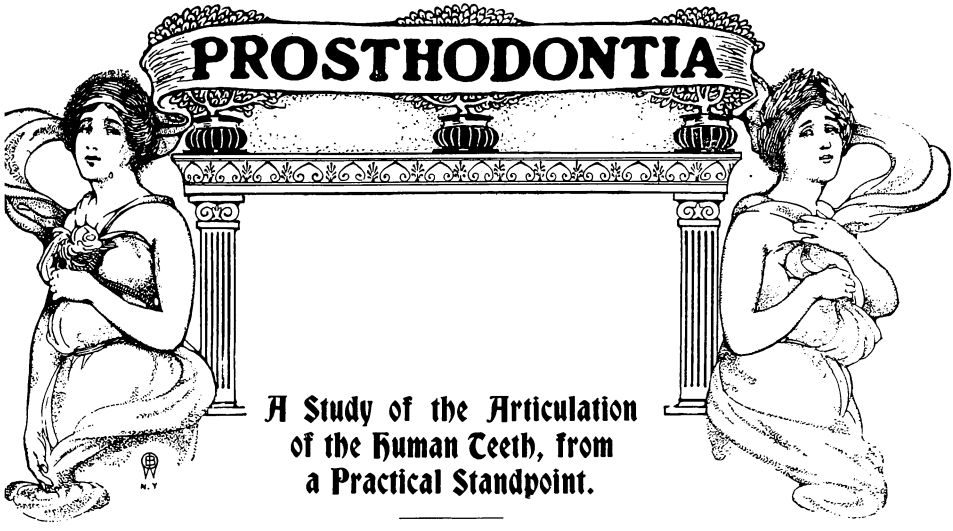
4. The lymph from the cementum and dentin flows into the lymph spaces in the pulp or intra-alveolar periosteum and is carried onward by larger lymphatic vessels in these two localities.

5. The lymph in and about the tooth passes to the perivascular lymph canals in the Haversian canals of the maxilla and mandible.

I am indebted to Dr. Edward Leaming, instructor in photomicrography at the College of Physicians and Surgeons (Columbia University), and of the Rockefeller Institute, for the photomicrography of the specimens shown in Figs. 172, 173, 174, 175, 182.

Dr. John L. Peters assisted me in photographing the remaining specimens. The preparation of all the specimens was done at the Laboratory of Histology and Physiology of the New York College of Dentistry.

* Aguilhon de Sarran—"Vaisseaux sanguins des racines des dents," *Gazette médicale de Paris,* 1880.



A Study of the Articulation of the Human Teeth, from a Practical Standpoint.

By Leuman M. Waugh, D.D.S., Buffalo, N. Y.

Read before the Second District Dental Society, December, 1908.

It will be the endeavor of the writer to present a résumé of the factors which govern the articulation of the human teeth, and to call attention to some of the more important phases, in which the resulting knowledge is of essential value in the near approach to the ideal in practical, every-day dentistry.

It will be best, first, to briefly review occlusion. This term implies the contact relations existing when the teeth of the upper and lower jaws are shut, and the mandible is at rest (Fig. 1). Normal occlusion, it should be remembered, must be regarded as an ideal condition, but rarely found in any type of individual. A knowledge of this perfect arrangement is of the utmost value, however, in every branch of dentistry.

In studying the occlusion on the lateral half of the jaws it will be observed that each tooth has two antagonists in the opposite arch, except the lower central incisors and the upper third molars (Fig. 2). In the incisors and cuspids the labial surfaces of the lower rest upon the lingual surfaces of the upper, which overhang for about one-third the length of their crowns. Bonwill called attention to the fact that the extent of this overbite corresponds to the depth of the cusps of the bicuspids, therefore it will vary in the different temperaments.

The bicuspids and molars, on each side, viewed collectively, may be considered as consisting of a series of cones or cusps bounding fossæ or depressions. These are so fitted together when the teeth are in

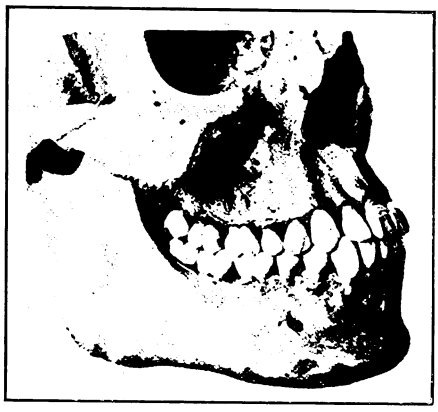


FIG. 1.

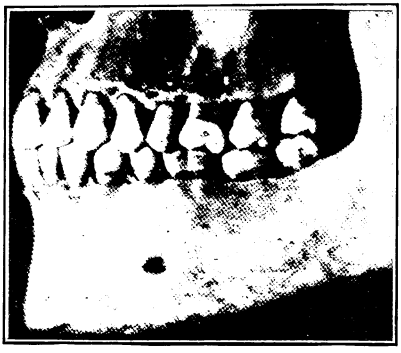


FIG. 2 (BUCCAL).

FIG. 2 (LINGUAL).

Fig. 1.—Normal occlusion from buccal aspect. Note the interdigitation of the buccal cusps, the overbite and the buccal compensating curve.—(Broomell.)

Fig. 2.—Occlusion from both buccal and lingual aspects, showing some thirty mortars and pastiles for the trituration of food.—(Turner, from a skull in the Wistar Institute of Anatomy.)

occlusion that the fossæ receive cusps of the opposing teeth. The line of lingual cusps of the upper are received into the groove between the buccal and lingual cusps of the lower, while the buccal line of cusps of the lower are correspondingly received into fossæ of the upper. Thus the lingual cusp of the first upper bicuspid is received between the buccal and lingual cusps of the lower bicuspids, the cusp touching the mesial marginal ridge of the second and the distal marginal ridge of the first. The lingual cusps of all the posterior teeth interdigitate, more or less

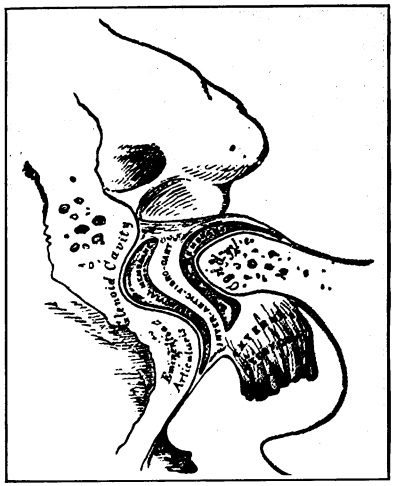


FIG. 4.

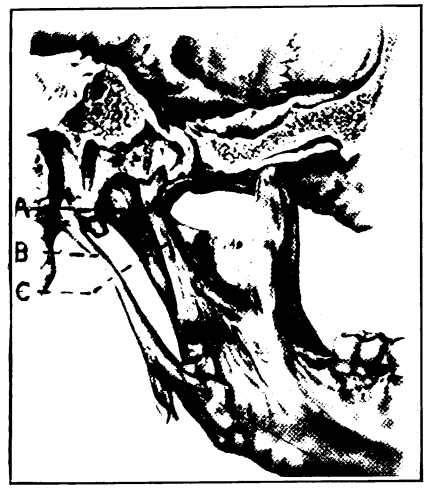


FIG. 3.

Fig. 3.—Vertical section through the temporomandibular articulation.—(Gray.)

Fig. 4.—The mandible suspended from the temporal bone, lingual aspect. (a) Capsular ligament; (b) stylomandibular ligament; (c) internal lateral ligament.—(After Deaver.)

similarly, the inclined planes antagonizing those of two opposing teeth, except the last upper molar, which occludes with but one tooth, the distal planes of the posterior cusps being disengaged. The summit of the buccal cusp of the upper first bicuspid is placed on a line with the interproximate space between the two lower bicuspids and to the buccal side. The general arrangement of the second bicuspid and molars is relatively similar. The lower third molar occludes with two upper molars.

Articulation of the Mandrils.

The articulation, or, better, the antagonization of the teeth is a mechanical problem, and its comprehension necessitates an understanding of the universal anatomic peculiarities of the temporomandibular articulation and the resulting movements of the mandible as they exist in the living subject. These joints are complex and bilateral, and afford freer movement of the mandible than exists with any bone in the body. Each of these condyles of the mandible articulates with the glenoid fossa of the corresponding temporal bone. The fossa is situated at the root of the zygoma, and is a mere depression, not corresponding in shape with the condyle which it receives, and which occupies only a part of it; the rear portion of the fossa containing a part of the parotid gland (Fig. 3). The articulating surface for the condyle extends

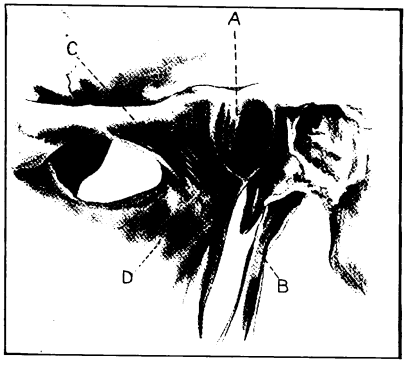


FIG. 5.

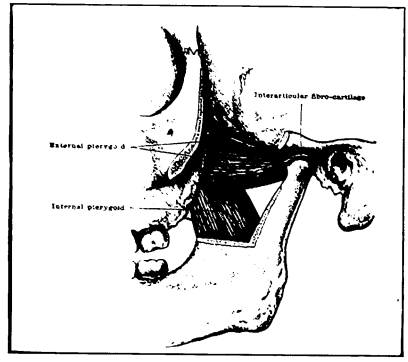


FIG. 6.

Fig. 5.—The mandible suspended from the temporal bone, buccal aspect. (c) External lateral ligament; (a) capsular ligament; (b) stylomandibular ligament; (d) ramus.—(After Deaver.)

Fig. 6.—Temporomandibular articulation. The ramus partly removed to show pterygoid muscles. Note the insertion of the external pterygoid partly into the interarticular cartilage.—(Morris.)

forward, beyond the fossa, on to a prominence, the *eminentia articularis.* Here it should be noted that the articulating face is inclined forward and downward. The condyle is suspended from a temporal bone by means of the capsular ligament (Fig. 4, a), which is attached below to its neck, and above to the edge of the articulating surface of the fossa and the eminentia; by the stylomandibular ligament (Fig. 4, b), which extends from the styloid process downward and forward to the ramus, near its angle; the internal lateral ligament (Fig. 4, c), which extends from the spine of the sphenoid to near the posterior dental foramen of the mandible. It will thus be seen that the mandible is permitted free forward movement. Its backward movement is controlled by the external lateral ligament, which arises from the posterior portion of the zygoma, and possibly by the postglenoid process. This ligament plays an important part in the mechanism of the joint (Fig. 5). Interposed between the condyle and fossa is the interarticular cartilage (Fig. 3), which is oval in shape, thin in the center—occasionally being perforated—thicker at the edges, especially at the posterior, its circumference joining the capsular ligament. There are two synovial sacs: one below the cartilage, interposed between it and the condyle; the other above the cartilage, placed between it and the fossa. The upper synovial sac affords a free direct forward movement to the mandible, it being advanced by the external pterygoid muscle, which is inserted partly into the interarticular cartilage (Fig. 6). When both external pterygoids contract simultaneously,

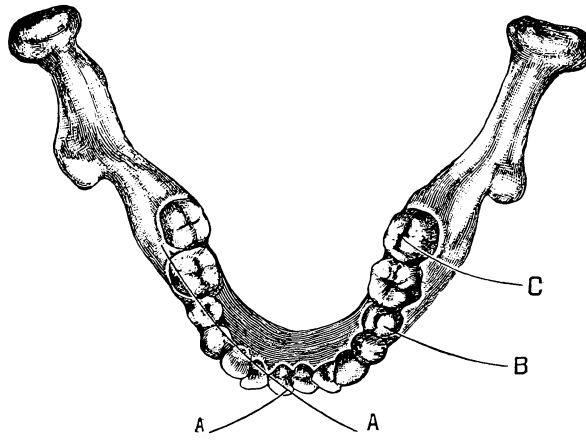


FIG. 7.

Fig. 7.—The mandible showing the occlusal surfaces of the teeth. The lines, a, a, are in the direction of tooth movement on the excursive side, b and c on the pivotal side.—(Snow.)

both condyles move forward in their respective paths, and the mandible is protruded. If one of them contracts, the condyle is drawn forward in its path, while the one of the opposite side, remaining in its socket, becomes the pivotal point, the mandible being moved laterally. The teeth on the pivotal side pass transversely and almost on a direct buccolingual line, while those of the opposite side move forward in the line of the arch with a slight inward curve (Fig. 7).

When the mouth is opened the condyle moves first in the lower synovial sac; then, when the lower edge of the external lateral ligament is rendered tense by the backward swing of the ramus, the point of insertion of its lower edge becomes a new center of motion. The neck of the condyle turns upon it, and its articulating surface, with the interarticular cartilage, moves forward upon the eminentia. If the mouth is opened very widely, as in yawning, the condyles pass still further forward along their respective paths.

Disregarding the topography of the masticating surfaces of the teeth, it will be seen that the occlusal surfaces will describe two curves, both of which are really compensating (see Fig. 8). The one extending anteroposteriorly, "the curve of Spee," the other passing laterally or at a right angle, more or less, to this. Therefore, when viewed buccally, an imaginary line intersecting the cusps of the upper and lower teeth will be curved, the concavity being upward. This curve, if continued

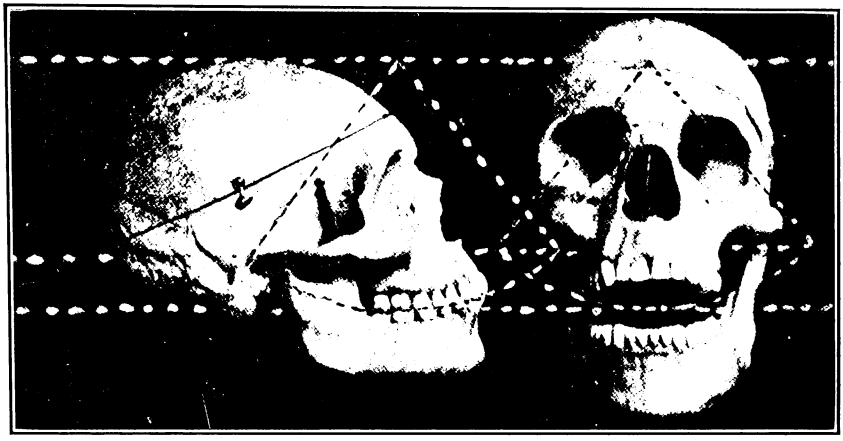


FIG. 8.

Fig. 8.—The same skull, viewed from both buccal and anterior. The lines show that the buccal and lateral compensating curves correspond.—(Prothero in *Dental Review*.)

backward, will very frequently coincide with the curve of the condyle-path. When viewed anteriorly, it will be found that the lingual cusps of the lower posterior teeth are placed on a lower plane than the buccal cusps, and that the lingual cusps of the upper assume a relatively lower position than their buccal cusps. The extent of this curvature is dependent upon the descent of the condyle-path; therefore, when its inclination is marked, the compensating curves will be relatively deep. If the condyle-path were horizontal there would be no curve in either direction, and the plane of occlusion would be flat and on a parallel with the condyle-path.

If an arc be struck from above having the same radius as that of the buccal compensating curve, and from a center located in the median line of the face, it will intersect the tips of the buccal and lingual cusps of the teeth on both sides of the jaw. Therefore, the buccal and lateral compensating curves represent arcs of a common circle (Fig. 8).

Here are rules for the prosthodontist of the utmost importance in constructing artificial dentures to replace the teeth of both jaws; and also those embracing all the teeth of one jaw and the bicuspids and molars of the other.

It seems reasonable to conclude that the depth of the compensating curve of the teeth is determined by the degree of inclination of the con-

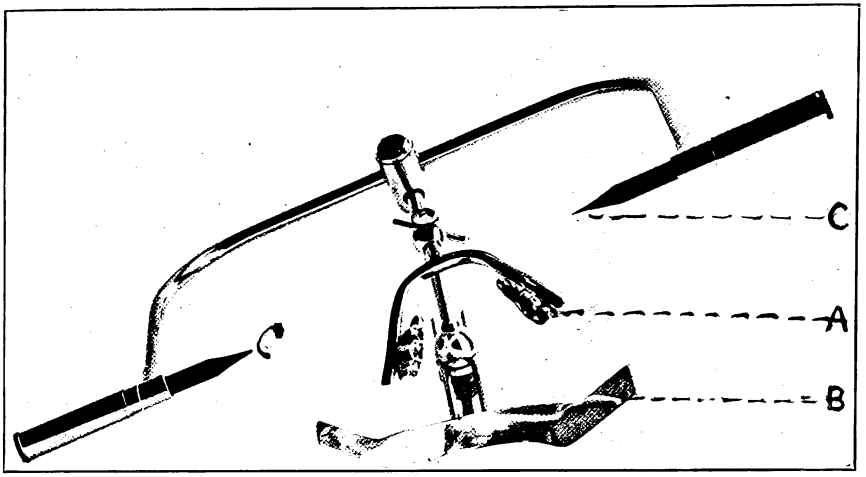


FIG. 9.

Fig. 9.—An instrument made to record diagrammatically the movement of the condyles. It is an elaboration of the Snow face bow, (a) is passed into the mouth and placed on the lower teeth. (b) Rests beneath the chin and, when clamped, fastens immovably to the teeth. The pencil points (cc) are adjusted over the condyles and will follow absolutely their course as the mandible is moved.

dyle-path, the effect being mostly produced during the erupting period of the teeth. This must be of especial practical significance to the orthodontist.

The movements of the condyle upon the *eminentia articularis* can be recorded diagrammatically by means of an instrument (Fig. 9) capable of firm attachment to the mandible and having an arm which will carry a pencil so that the point will touch the cheek directly over the center of the condyle. The point will then follow closely the movement of the condyle (Fig. 10). Usually the diagrams thus obtained are more or less curved, the concavity facing upward. The degree, both of curvature and inclination, varies in different subjects, and frequently on the two sides of the same subject (Figs. 10, 11, 12 and 13). The instrument is an elaboration of the Snow face bow, and should be of value to the orthodontist in recording the changes resulting in the condyle-path in irregularities, the correction of which is modifying the anatomy of the temporo-mandibular articulation.

Walker has pointed out that the average angle of descent of the condyle-path is 35 degrees, and that it varies from the horizontal to 50 degrees. As instances of asymmetry of the paths he mentions two cases, one in which its angle with the occlusal line was 1 degree on one side

FIG. 10.

Fig. 10.—The instrument shown in Fig. 9, adjusted to the face.

and 10 degrees on the other; and one with 22 degrees on one side and 44 degrees on the other. (*Dental Cosmos,* 1896, January and July.)

From the foregoing it will be understood:

First—That the contact existing between the teeth of the upper and lower jaw is governed by the temporo-mandibular articulation.

Second—That a general knowledge of this joint is necessary to the comprehension of the fundamental principles underlying the antagonization of the teeth.

Third—That in no two individuals is the joint formation identical; and that in many cases there is a considerable variance in the two sides of the same individual.

Fourth—That its formation and varied movements can not be exactly observed in the living subject by any means now available.

It will thus be seen that the study must be made outside the body, and that any given case will possess individual characteristics of practical importance. As these facts became gradually recognized, they compelled the production of mechanical devices by which the relations which exist between the occlusal planes of the maxillæ and the condylepaths might be reproduced, and the various movements imitated with sufficient accuracy for practical application.

FIG. 11.

FIG. 12.

Fig. 11.—Resulting diagram of the condyle-path marked on the face, right side.

Fig. 12.—Resulting diagram of the condyle-path, marked on the face, left side. Note that they vary slightly in curvature and inclination.

This, it seems, had a more direct practical bearing in the construction of artificial dentures, and evidently stimulated the prosthodontist to endeavor in this field, as it is to him that the profession owes the debt of gratitude for its invention.

A brief reference to its evolution will be of interest and will serve to give a better idea of efficiency of the present apparatus.*

Evolution of Anatomical Articulator.

The first recorded effort was made by David T. Evans, of Philadelphia. In 1840 he patented an articulator, in which the joints were slotted, for the purpose of imitating the lateral and protrusive movements of the mandible. The slot representing the condyle-path was horizontal (Fig. 14).

*The historic data concerning the Evans articulator and the apparatus of Dr. Hayes were furnished by Dr. George B. Snow. The accompanying illustrations were possible also through his kindness, as the apparatus is part of his private collection deposited in the museum of the University of Buffalo, Dental Department.

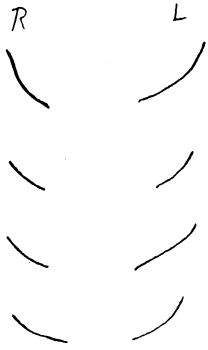


FIG. 13.

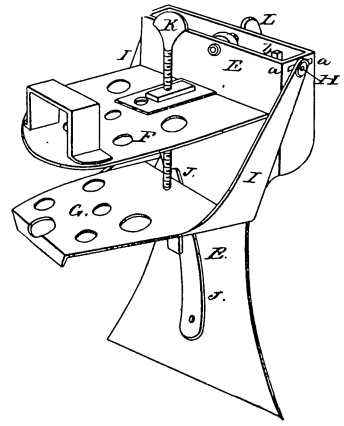


FIG. 14.

Fig. 13.—The diagrams of four condyle-paths. Note the variance on the two sides.—(Snow.)

Fig. 14.—First known effort to construct an anatomic articulator. The patent was granted to David T. Evans, of Philadelphia, in 1840. It shows at (a) the slotted joint for imitating the lateral and protrusive movements.

W. G. A. Bonwill, also of Philadelphia, in 1858, gave the profession his articulator with which all are familiar (Fig. 15). This instrument is faulty in two important principles: (a) the condyle-paths are horizontal and fixed; (b) it will not permit of adjustment to individual cases. The principles which he propounded concerning tooth articulation are extremely valuable and have had a far-reaching effect not only for their practical value, but for the stimulus he gave others to endeavor in this field. He did not appreciate the importance of the "face bow," and stolidly repudiated its worth.

Richmond S. Hayes, of East Bloomfield, N. Y. (Fig. 16), was the first to recognize the inclined movement of the condyle, and the importance of placing the models in the articulator at the proper distance from the joints. He designed an articulator with fixed descending paths. He also invented an "articulating caliper," the arms of which were placed over the condyles, and by means of a movable point he obtained the distance, the device measuring this one relationship only. The two instruments were designed for combined use and were a great advance (Fig. 17). Although he himself used these with success, he did not succeed in having them adopted by the profession.

W. E. Walker, of New Orleans (Fig. 18), in 1896, made known the results of his exhaustive scientific study of condyle movement and advanced principles, that were new and conclusive. He also invented

FIG. 15.

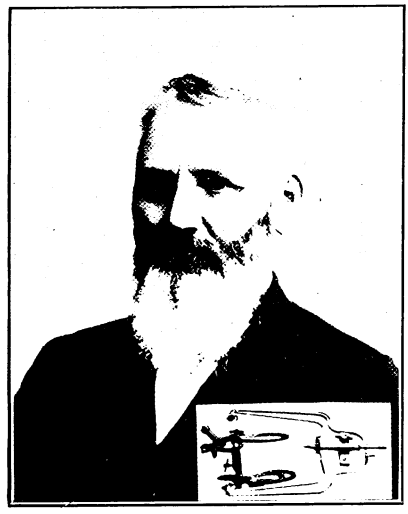


FIG. 16.

Fig. 15.—Dr. W. G. A. Bonwill and the articulator of his design supporting a set of teeth, ground by him after the principles he propounded.

Fig. 16.—Dr. Richmond O. Hayes, East Bloomfield, N. Y., was the first to recognize the descent of the condyle and the necessity of placing the models at the proper distance from the joint. He devised an articulator with fixed descending paths and a "facial caliper" for the purpose.

what he chose to call a "dental facial clinometer," for registering the condyle movement, and an articulator which was an improvement on the Bonwill, in that the inclination of the condyle-path could be established independently on either side (Fig. 19). The apparatus, while quite accurate, was so complicated that it did not come into general use. It was deficient in that it did not establish the relations of the occlusal plane to the joints.

Prof. Carl Christensen, of Copenhagen (Fig. 20), about 1901, made a substantial advance, in that he brought out a simple, practical method of ascertaining the inclination of the condyle-paths. This he did by the placement of small pieces of soft wax upon the extreme rear of the articulating surface of the lower trial-plate. By having the patient bite with the mandible protruding, so that the articulating surfaces of the trial-plates meet anteriorly, the descent of the condyle causes more or less separation of the plates at the rear, which is registered by the resistance of the wax. This is then transferred to his articulator, which much resembles the Walker in the joint mechanism (Fig. 21).

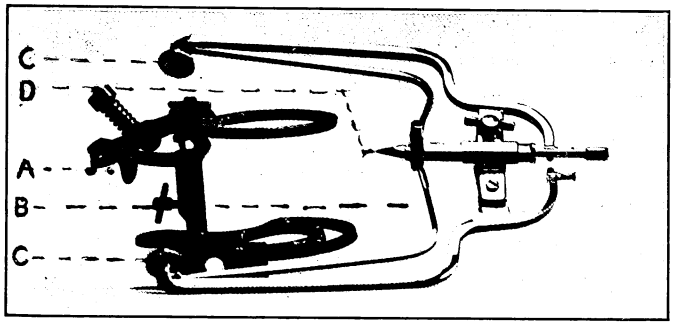


FIG. 17.

Fig. 17.—The Hayes apparatus (a) shows the fixed descending condyle-path; (b) the articulating caliper. The parts (cc) are placed over the condyles; (d) is an adjustable bar the point of which is pressed into the wax rim of the upper trial-plate while in the mouth and the caliper tightened. This will show the exact distance of the front of the models from the joint when adjusted to the articulator.

There had, so far, not been a recognition of the importance of reproducing the relations existing between the occlusal planes of the maxillæ and the condyles, and it remained for Dr. George B. Snow (Fig. 22), professor of prosthetic dentistry, University of Buffalo, in 1899, to point out to the profession this previously unrecognized essential. For the purpose of establishing these relations he devised the simple and efficient face bow, which bears his name. This was the most important advance so far made, *as no articulator, no matter what its perfection in simulating the anatomy of the temporo-mandibular articulation, could give correct results without a means by which the anatomic relations of occlusal planes and condyle might be transferred to it.* It has been used with the articulator designed by A. De Witt Gritman, then of the University of Buffalo. This has fixed descending paths, the pitch being the average of the measurement of some fifty mouths. In 1907 Dr. Snow brought out the New Century Articulator, which differs from the Gritman, in having adjustable joint slides (Fig. 23, d) for imitating the condyle movements of the individual case. He also devised the "bite gauges" (Fig. 23, f), which are an improvement on the small pieces of soft wax, suggested by Christensen, for determining the condyle-path.

While Dr. Snow must be given great credit for bringing the apparatus to its present state of almost practical perfection, he has requested me to say that he could probably not have worked out the apparatus of his invention, had it not been for the important work that had been done

FIG. 18.

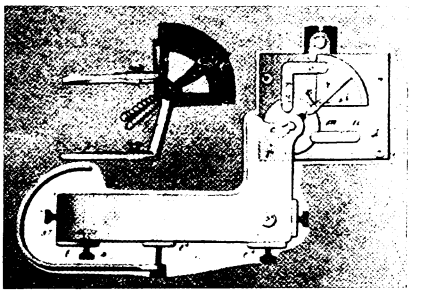


FIG. 19.

Fig. 18.—Dr. W. E. Walker, who invented the "dental facial clinometer" for measuring condyle movement. He also designed the first articulator with adjustable condyle-paths.

Fig. 19.—Dr. Walker's apparatus, (a) the "dental facial clinometer"; (b) the articulator, with adjustable condyle-paths.

by some of the investigators who have been mentioned and others.

Technique of Using Face Bow.

The technique of the use of the face bow will now be briefly outlined, together with the placing of models in the New Century Articulator, in their anatomically correct positions. The progressive steps in mounting models of edentulous mouths and those with teeth will differ but little. The slight variations will be pointed out.

Models are obtained. If for an edentulous mouth, the usual process of trimming and adjusting the trial-plates, known as "taking the bite," is performed. The antagonizing surfaces of the two plates are trimmed flat, and when they are in the mouth, the antero-posterior direction should be in the "occlusal plane." This is defined by Dr. Walker as "touching the disto-buccal cusps of the lower second molars and the cutting edges of the incisors." But it happens that a line drawn from the floor of the auditory meatus, passing forward on a level with the root of the nose, will be so nearly parallel with the occlusal plane that it may be used for the purpose of establishing it.

As the tissues of the temporo-mandibular articulations are elastic and slightly compressible, the trial-plates should be bitten upon with some

FIG. 20.

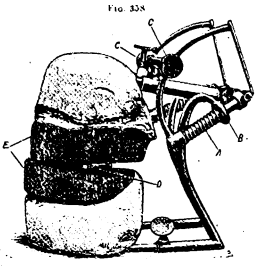


FIG. 21.

Fig. 20.—Prof. Carl Christensen, Copenhagen, who thought out a simple and accurate means of measuring the descent of the condyle. He also devised an articulator with adjustable paths similar to that of Walker.

Fig. 21.—Prof. Carl Christensen's articulator with models and trial plates, the rear separated by the small roll of wax (d), which registers the amount of condyle descent.—(*Dental Cosmos.*)

FIG. 22.

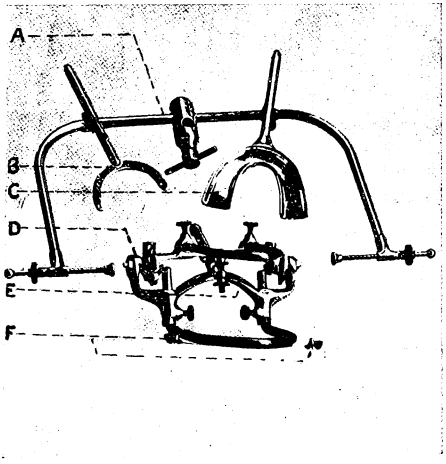


FIG. 23.

Fig. 22.—Dr. George B. Snow and the apparatus of his invention.

Fig. 23.—The Snow apparatus complete to date. (a) The face bow; (b) the mouth-piece for edentulous mouths; (c) the mouth-piece for use when the natural teeth remain, as used for diagnosis in orthodontia; for making interdental splints, etc.; (e) the New Century Articulator with adjustable condyle-path; (d, f) the bite gauges for registering the pitch of the condyle-path.

FIG. 3.

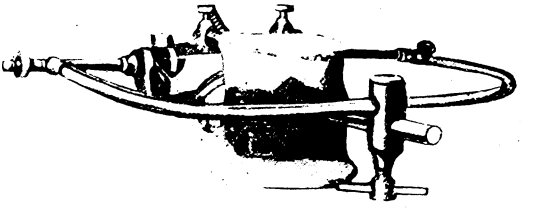


FIG. 24.

Fig. 24.—The face bow adjusted to New Century Articulator and models. Models fastened with plaster, thus establishing the exact relations of the models to the joint.—(Wilson, in *Dental Cosmos.*)

force in antagonizing them; or there may be too much bearing upon the molars when the plates are finished.

A "bite gauge" (Fig. 23, f) can now be placed at the extreme rear of each end of the lower plate, and a bite taken with the mandible protruded, say a quarter of an inch. The gauges are then removed and laid away for future use.

The high and low lip, the mesial and the lateral vertical lines are now made upon the wax rims. Then the face bow (Fig. 23, a) is used, its mouthpiece (Fig. 23, b) being heated and attached to the wax rim of the upper trial plate. The plates, with the face bow attached, are transferred to the articulator, and plaster models are mounted therein (Fig. 24).

When the models are securely set, the bite gauges are replaced, the spring of the articulator is unhooked, and the trial-plates are brought together, the lower one being protruded to the same extent as it was in the mouth (Fig. 25, a). This is shown by the impression which the bite gauge has made in the upper wax, the impression showing not only the amount of protrusion, but the amount of separation of the two plates at the rear. The gripping screws of the joint slides being loosened so that the slides can turn freely, they will assume their correct positions automatically, and it only remains to tighten their screws and so hold them at the correct angle. The bite gauges are removed, the springs hooked and the case is ready to be worked upon.

Technique when the natural teeth remain in the mouth.

Make models. Adjust the bow to the width of the face. Use mouthpiece "C" (Fig. 23), filling it with soft wax; place it in the mouth

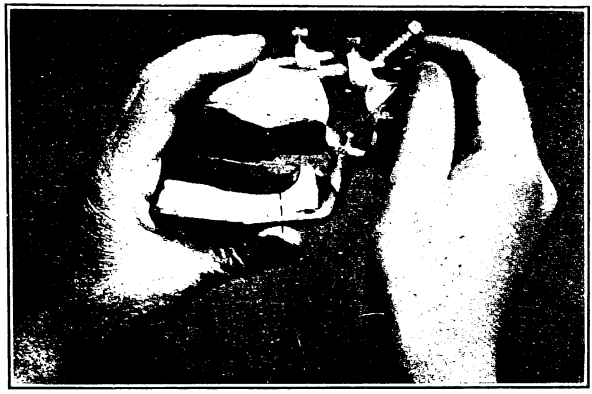


FIG. 25.

Fig. 25.—The bite gauge replaced, the mandible protruded showing the amount of separation at the rear, thus automatically determining the pitch of the condyle-path.—(Snow.)

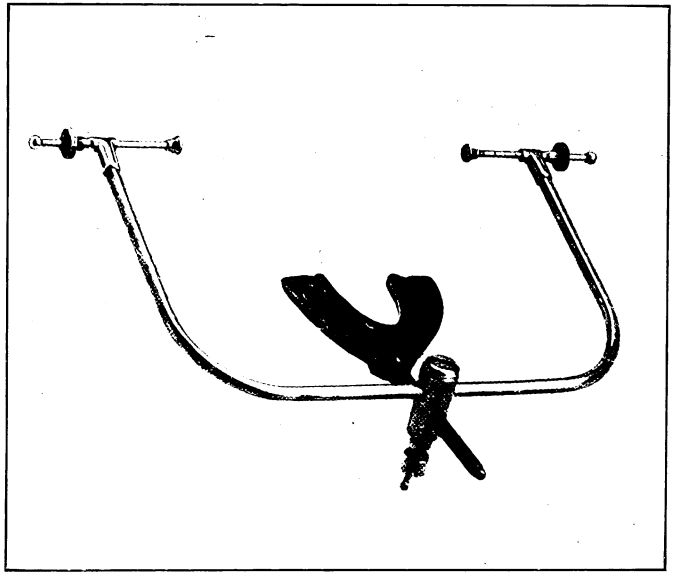


FIG. 26.

Fig. 26.—Face bow removed from the mouth containing the natural teeth with the bite taken.

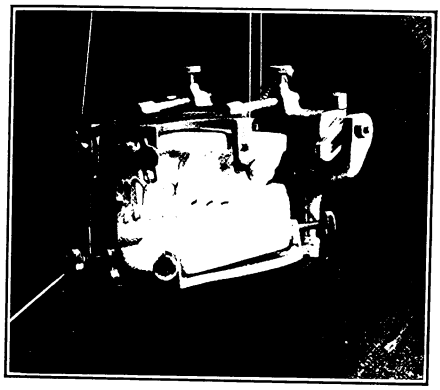


FIG. 27.

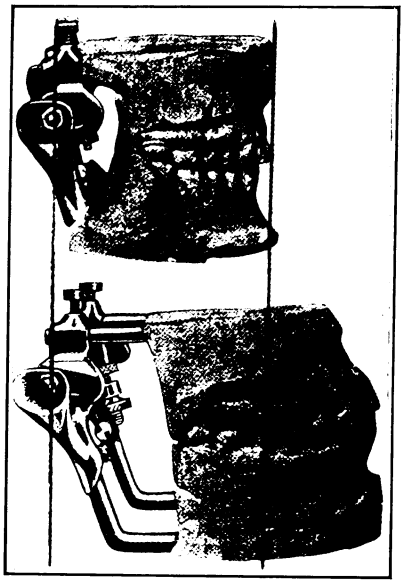


FIG. 28.

Fig. 27.—The New Century Articulator carrying plaster models in special supports to obviate the necessity of attaching with plaster. These are suggested especially for the orthodontist.

Fig. 28.—Two cases mounted with Snow face bow. These will serve to show variance in distance from the joint. Note that the upper central incisors in the one above are on a line with the distobuccal cusp of the upper first molar in the case below.

and have the patient close. This will give an impression of the occlusal halves of the upper teeth (Fig. 26). Adjust the face bow and tighten securely. Remove from the mouth, place the upper cast in position on this bite and fasten to the articulator. This will establish the relations of the upper cast to the joints.

The pitch of the condyle-path is established by taking the ordinary old-fashioned "mush bite," the patient protruding the mandible not over five millimeters. This is now transferred to the articulator as per description for edentulous mouths, the mush bite having taken the place of the bite gauges.

Some of the more important phases in which the described apparatus will have practical application are:

First—In the construction of artificial dentures for the replacement of all the teeth of both jaws, and for cases involving all of one jaw and the molars and bicuspids of the other.

Second—In the construction of crowns and bridges for a considerable number of posterior teeth. This is especially important when the work involves antagonizing areas.

Third—In the construction of interdental splints, an accurate fit can not be obtained without it, when the bite has to be opened.

Fourth—In orthodontia, as a means of diagnosis and in recording progress, especially the cases involving a change in the anatomy of the temporo-mandibular articulation.

Fifth—The knowledge gained by the use of this apparatus will be valuable as an aid in determining the correct outline of large cavities involving the occlusal surfaces; also in determining the position of contact points so as best to resist stress and protect the gum septum.

In this connection it is desired to call attention to the prevalent practice of reducing large fillings, so that they are relieved of all occlusion. When many such are made in a mouth the unreduced stress of mastication is increasingly thrown upon the gradually diminishing tooth structure, thereby predisposing the crowns to fracture.

The writer does not wish his attitude, with reference to the described apparatus, misunderstood. It is not advocated that it be employed in every case. A plea is made, however, for its careful application in such cases as involve the replacement of considerable areas of occlusion of the posterior teeth, and that the resulting knowledge be applied to practically all work involving the restoration of tooth structure. By this means will be obtained the highest degree of efficiency in mastication, coupled with the least danger of fracture of tooth structure. Thus will be secured a condition of mutual support of the teeth, both in occlusion and articulation, that will for the longest possible period of years result in the retention of the natural dental organs by a conservation of the integrity of the pericemental membranes.

The Vestibule Bow Lower Denture.

Being a Method for Restoring Lower Molars of One or Both Sides without Means for Anchorage Distal of the Space.

By P. B. McCullough, D.D.S., Philadelphia.

Read before the Central Dental Association of Northern New Jersey, March, 1909.

The proposed use of natural teeth as supports for artificial substitutes in any given case, requires consideration for the extent and character of stress which Nature designed natural teeth to withstand.

The very contemplation of such a study at once suggests the extent of abuse tolerated by Nature, as reflected by the teeth, in making possible the use of the multiplicity of appliances daily employed, having little mechanical merit, at variance with physiological law and unscientific as artificial substitutes.

Yet it so happens that such bridges are practical, as measured by the understanding of the period, or graduated by degrees of practicability according to the individual observer's standards of measurement.

For the character of denture here considered it will suffice to state, as a purely mechanical factor, that the direction of force in the molar region is vertical and lateral, and that the greatest force is exerted vertically; therefore, to subject the abutments to a lateral force greater than that which they were naturally designed to withstand, means the earlier loss of the supports and failure of the appliance.

Notwithstanding this self-evident truth, it appears that all attempts to supply the lower molars without means for distal support, are in direct disregard of this fact.

To conform with this first limitation requires that the appliance must admit of the greatest vertical stress and least lateral strain. The only foundation available in an edentulous space to resist direct stress is the ridge; but for use in mastication it is further necessary that the plate should resist movement forward, backward, upward and sidewise.

With the vestibule bow in its simplest form, all movements are provided against except the tendency to rise from its seat. To overcome this play, three styles of attachments are used. These will be described as they apply in constructing the plates.

Technique for Bilateral Plate.

The order of procedure for constructing the bilateral plate is to take separate impressions of the ridge of each side and of the labial surfaces of the teeth and gums. Saddles of one thickness of plate are swaged, and for the bow four thicknesses of 30-gauge clasp gold. For convenience in adjusting the sections it is desirable that the first

piece of plate be swaged to cover a part of the labial surfaces of the teeth, as with this provision the bow is more certainly held in position while fixing its relation to the saddles in the mouth.

With one saddle and bow in position in the mouth and both being held fixed, plaster is placed over one end of the bow and the saddle, so that when hard the sections may be assembled on the plaster out of the mouth, invested and soldered. In like manner the second saddle is adjusted and soldered. (Fig. 1.)

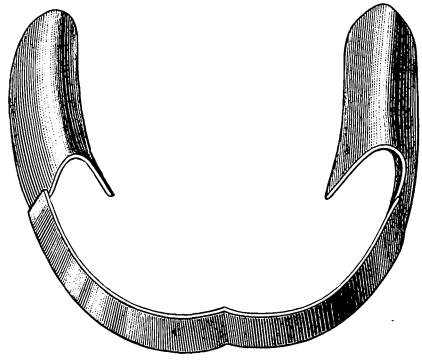


FIG. 1.

The simplest form which this plate can have requires the additional attachments to the natural teeth preventing the vertical play of the plate.

Suppose the plate, as described, be for the two molars on each side; then each first molar is made of gold in order that within may be held a spiral spring actuating a lug extending out of the mesial surface to engage a countersink in an inlay in the distal surface of each second bicuspid.

Where more teeth are to be supplied or the space is irregular, as in the case from practice shown in Fig. 2, then telescopic crowns are required.

As the practice of covering the occlusal surfaces of the molars with gold crowns as a means for anchorage is based upon a misconception of the requirements for such cases, the proper attachment consists of a band adapted to all that part of the vertical walls of the ground tooth. The second and telescopic band is made to fit the first, of such thickness as the required strength demands, and of form to restore the original contour of the tooth. (Fig. 2A.)

The same method is used for a bicuspid where the natural crown remains, and the display of gold is admissible.

Method of Crowning.

Where parallel alignment of the telescopic sections, or the need for concealment of gold, requires the removal of the natural crown of any of the anterior teeth, the following method is believed to be the best:

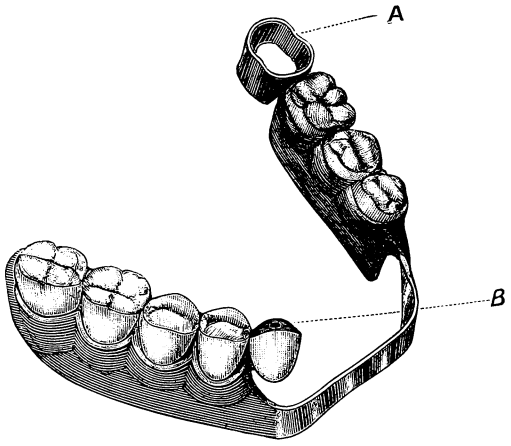


FIG. 2.

After the natural crown has been removed the root is reduced with a wheel stone and beveled with a cone bur, in either the right angle or straight hand piece.

An impression tube of conical shape is made of German silver or copper plate, and shaped to cover the prepared surface of the root; with the mouth of this tube filled with a quick-setting cement it is pressed to place on the root and held fixed until the cement is hard. The tube with impression is dropped in formalin for a few minutes, then wrapped with paper and bound with waxed thread, forming a paper matrix around the impression, in which cement is packed and held under pressure, making the model.

The trimmed model is waxed to a circular block of plaster for convenience in handling. Then a piece of 3-1,000 platinum is held in position on the model and the margins turned down on the bevel with a burnisher. A 28-gauge 22 k. gold band is measured around the bevel, the ends joined and soldered. The platinum cap annealed is returned to the model, the band pressed to place over and around the cap, thus drawing the cap tight to the bevel, the two are removed adherent and united by liberally flowing solder over the cap, thus reinforcing the thin platinum.

The margins of platinum extending beyond the bevel are trimmed away and ground to conform to the lines of the bevel on the model. With an elongated flattened pyramid-shaped pin, of the greatest bulk the case will permit readily, a hole is drilled in the center of the cap, and, with a fissure bur, enlarged to shape of pin, so that the latter will enter for two-thirds its length.

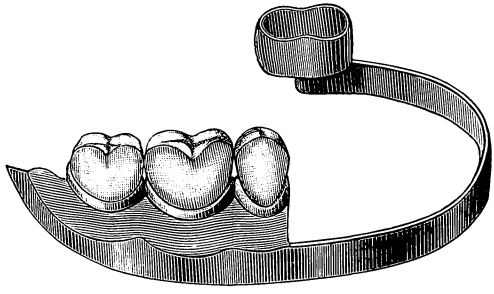


FIG. 3.

Then the cap is placed on the root, the pin pressed to place, the two removed adherent soldered without investing and returned to root.

At this point a plaster impression is taken for transferring to a plaster model—in this case—the left third molar fixed band and the right cuspid cap. In order that the impression may be removed without fracture, all the natural teeth present are covered with wax.

With the sections on the model the cuspid cap is warmed, and a particle of hard wax is placed inside the lingual margin on the cap. Then the previously made split post is heated and made adherent to the cap. The free end is then inclined in whichever direction is required to make it parallel with the molar band. This obtained, the cap is pried off, the model invested and the split post soldered to the cap.

With the cap returned to the model a thin cuspid facing is ground to the cap and to alignment, with the split post between the facing pins. With the cap, split post and facing slightly oiled, inlay wax is pressed to place over post, pins and back of facing, the wax model removed and the facing pin holes filled with graphite, invested, and cast by pressure.*

*It is so delicate an operation to adapt the inlay wax without changing the position of the facing that the writer prefers to fix the facing to the cap with wax, remove the two adherent from the model and imbed them facing down in soft plaster. This permits, when the plaster is hard, of pressing the inlay wax with force over the telescopic post, back of facing and pins, without danger of changing the relation of facing to cap.

The plate with molar ring soldered is placed in the mouth with the cuspid crown, a plaster impression taken of the crown and a part of the plate, the sections removed, assembled in the impression, invested and the crown soldered to the plate. (Fig. 2B, showing hole back of facing to receive split post.) The plate is returned to the mouth with wax for the bite, when the teeth are assembled and fixed with vulcanite or soldered as desired.

The order of procedure in the case, illustrated in Fig. 2, was as follows:

After the two saddles and the bow had been swaged, straps were soldered on the lingual surfaces of the saddles to hold the vulcanite. The two sections of the molar telescope crown temporarily in situ, the left saddle held in position, a plaster impression was taken of crown and a part of the saddle, removed, invested, and the impression plaster cut away. The space between the distal margin of the saddle and the near surface of the molar band was bridged by adjusting several thicknesses of plate to join the sections; then the parts were united with solder. In the same way the relation of the remaining different sections was fixed with plaster in the mouth, the bow soldered to the left saddle, then to the right saddle and finally to the sliding section of the cuspid crown. After vulcanizing, the cuspid facing was set with cement and the pins riveted.

Unilateral Plate.

With the description above given little remains to be said of the unilateral piece (Fig. 3). The saddle and bow are swaged separately as described. In the choice of the anchor tooth on the side of the jaw opposite the space to be filled, preference should be given to the first molar. Conditions of decay, or other reasons tending to the conservative, would justify the use of another tooth.

The last natural tooth anterior to the space to be filled must be fitted with one of the three attachments, namely: The gold inlay with countersink to receive sliding lug extending out of mesial surface of the near artificial tooth, telescopic bands, or the telescopic crown as described for the cuspid in Fig. 2B.

Discussion of Dr. Grieves's Paper.

Dr. C. A. Hawley. No one here can question the results which we have had presented before us. They can only be disproven by a long and exhaustive study of the problems, as Dr. Grieves has given. We are extremely fortunate in having a man to investigate the matter as carefully as has Dr. Grieves, and fortunate in having him present it as one who is not practicing our specialty. His report is thus impartial. We must discuss such matters in an absolutely scientific manner.

His findings agree remarkably with my own clinical experience. For the last two years I have had considerable experience in the use of the noble metals. I have said many times that I did not think I injured the teeth either with German silver or with the noble metals. The question now is whether I have not injured many teeth in both ways, for I have not examined those teeth microscopically. I believe we have had injuries to teeth with both metals. Since using the noble metals I have found that patients wearing such arches need more attention.

I have no doubt that in many cases the care of the mouth can be such that German silver can be used without much detriment, and as Dr. Grieves has found, it has its value: there is an element that makes for the preservation of the tooth. Now, whether the detrimental influences of that metal are such as should cause us to abandon its use, is the question for us to determine. I took up the use of the precious metals mainly from the standpoint of their strength. I have made a number of tests of noble metals in comparison with German silver as to

their tensile strength. Those were made at first by a man in the State University of Columbus. He has now moved to Iowa.

In three sets of tests the counts favored the noble metals. It has been stated during the past year, in one instance at least, by the editor of the Orthodontia Department of the *Western Dental Journal,* that German silver is the stronger; that no metal will take its place when rolled into thin strips. The tests made by Professor Fish have disproved that. I did not get as great strength with it in thin strips as with iridio-platinum.

In tests recently made, one sample of German silver, of the thickness of clamp bands and of the same width, has shown greater strength than a similar piece of iridio-platinum. That is the only one that has shown equal strength in my tests. So far as the spring of the arches is concerned, the tests I have made have been in favor of the platinous gold arch. I had intended to bring with me a little instrument for testing in ounces the spring of these materials. I took many old arches and tested them; also new arches. There is no value in the German silver as to spring power over the noble metal arch, nor in the life of the metal.

After nearly two-years' use of platinous gold arches, so far as the injury to the teeth is concerned, I may report as follows: I have not examined teeth with a microscope, but with the naked eye. My experience is that there would be more danger than where German silver is used, but this danger can be entirely obviated by proper care of the patient. In no case, where the patient has taken proper care of the teeth, and received proper attention from myself, has there been any injury to the teeth. I think the detrimental influence can be entirely obviated by proper care of the patient, but it means greater care, and that is something which we should all take into consideration in future.

Dr. Rojo. I wish to thank the essayist for his excellent paper; he has beautifully shown his experiments, and explained fully how bad the German silver appliances are. I have been testing all these appliances and I agree with him that the noble metal appliances must take the place of those constructed of German silver.

Dr. Rogers. In his discussion Dr. Hawley brought up the point that it is possible to prevent any ill effects on the teeth by proper care of them. I have discovered a very effective method which may be used by the patient. Use a very small brush, with a single row of bristles. If the nurse or mother is instructed in the proper use of this brush, excellent results will be gained. I have been so impressed with the advantages of this brush, to be used by

the children, that I purchased two or three dozen of them and wish to present one to each member. I wish each one of you to take one of them, remembering the fact that it will accomplish wonders when used in accordance with proper instructions.

Dr. Hawley. I have used this roller brush referred to for more than a year, and always give the patient instructions as to how it shall be used.

Dr. Kemple. I wish to express my delight at listening to this paper, because I believe Dr. Grieves has presented a subject that is of vital importance not only to the orthodontist, but to every dentist who attempts the correction of malocclusion in any way. It is gratifying when a person can have his own humble opinions supported by such proof as Dr. Grieves has presented. In Detroit last year Dr. Pullen introduced this subject of noble metals versus base metals, as used for regulating appliances, and in the discussion at that time I referred to the more careful cleansing of the teeth which I thought would be required where the noble metal appliances are used. In some of the reports of that discussion I was credited with recommending the use of German silver appliances in preference to those of noble metal; but I did not do that, because I have not been using the German silver appliances.

In regard to the point made by Dr. Rogers, I have felt the difficulty of securing the cooperation of the patient with one or two exceptions, or of the parent or nurse, to such an extent as would insure the absolute cleanliness of the child's teeth, whether they use the rolling tooth brush or any other. Dr. Rogers gave me one or two of the little tooth-brushes having the single row of bristles in Boston a year or more ago, and since then I have had my patients use this brush, along with the other brushes. I believe the responsibility of cleaning the teeth rests absolutely on the shoulders of the orthodontist. We can not depend upon the patient, parent or nurse for keeping the teeth clean. The arches and ligatures must be taken out of the mouth at very frequent intervals and the surfaces of the teeth polished. I can see but one way of accomplishing that, and that is to remove the appliances, and not only cleanse the labial and lingual surfaces, and make use of floss, etc., but to polish every interproximal surface. I want to thank Dr. Grieves for the points he has brought out in the paper, and to express my appreciation of his devoting himself as he has to such an exhaustive study of the subject.

Dr. Barnes. I am thankful we have had such a paper presented in so able a manner. It is thoroughly scientific. Dr. Grieves has spoken about the devil and the deep sea; it is true we are in such a position. We get certain effects

with German silver and certain effects with the noble metals through carelessness. We may draw this conclusion: that as much of our treatment as possible must be expended upon the temporary teeth. There we can eliminate the decay problem and produce an effect on the permanent teeth without much actual application to the permanent teeth. We must realize the fact that the children must keep the appliances clean. Many of these cases show us the very worst of mouth conditions.

One fact might be considered in the use of German silver which has not been brought out, and that is, if the appliances made of German silver should involve the principle of fixation in one direction and flexibility in another, so that the teeth can move, that will have the effect of renewing the surfaces of the German silver. A certain friction is thus produced. I think Dr. Grieves's conclusions must make us realize that we must eliminate ligatures as much as possible; also, that we must cement bands to place. We must have no gold plate where we use German silver. If we use noble metals it must be with a distinct warning to the patient. In the German silver, if discoloration ocurs, that is a warning to the patient that cleaning is required.

Dr. Young. Dr. Grieves told us in the beginning he was simply scraping around the edges of the subject. I hope he will keep on, because I think he has given it a pretty good dig. I would like to ask him in regard to the x and z spring gold which he spoke of testing as to the load it would bear, whether it was annealed or not?

Dr. Grieves. It was just as it came from the manufacturer. The jeweler did not anneal the gold. It was just as it was purchased.

Dr. Young. Did you purchase the gold in the gauge in which you used it?

Dr. Grieves. Yes.

Dr. Young. I think you will find, if the two arches are annealed, the one that has the least copper in it will be much softer and have nothing like the spring that the other will have, and, consequently, you can solder the one with 22 k. solder; *i. e.*, arch hooks, and still maintain the spring, while with the other one you can not.

Dr. Grieves also spoke of ligatures. I have been talking with him about the ligature question, and I want to pass around a ligature I had in a mouth for probably ten-days' time. It is made of sterling silver wire, and you will observe that where twisted over the arch it is very black, while all the rest of it, which was under the gum margin, is as

bright as when placed in the mouth. I have been using these ligatures but a very short time, but so far as I have used them, they work more nearly like the brass wire ligature than anything I have found. I have used gold ligature wire for two years, but it has not proved satisfactory. This silver wire I believe will work out very nicely. I am satisfied that it is a mistake to use brass wire ligatures around a gold arch. I have come to the same conclusion as Dr. Grieves in that respect. As I reported in Detroit a year ago I have had trouble because of dissolution of the enamel surfaces on the anterior teeth, upper and lower. I believe when we exclude all base metals from the mouth we will have very much less trouble with any deleterious action on the teeth from gold appliances.

Here is a raw silk ligature which may be secured in Paris. I told Dr. Grieves I like it because it shrinks for a long time, but that it does become foul and set up irritation. I suggested sterilizing, or treating it with ten per cent. silver nitrate. He suggested using another solution. Van Horn and Sawtelle told me absolutely that silk ligatures will not shrink. I replied, "Then I have not been using silk; for the material I have used will shrink for five months in constant use." I sent a couple of skeins to Mr. Sawtelle; he now says it is silk. I said, "Then you are wrong." Last Friday he told me he thought he would be able to treat this material so that it will be permanently sterile in the mouth, and if he does, I believe that between the silk ligature and the silver wire, we can dispense with anything else for ligatures. The silver wire was in part annealed, and part not. Unannealed silver will be bright, and the annealed will have a whitish appearance. You can only procure the silver wire to order. It was originally prepared for use in surgery.

The essayist also spoke of systemic troubles from the effects of German silver. This is a subject that I would like to hear more about, especially from the men who have been at this work for a number of years, and using German silver appliances. I have had one patient where it was a very grave question if there was not a systemic effect from German silver; there was a pronounced stomach irritation, and the patient has improved very markedly after the removal of German silver appliances. I am not, however, prepared to say that caused it.

Dr. Watson. Were the German silver appliances replaced with those made from other metal?

Dr. Young. The child was in so delicate a condition for a time that if the German silver was to be removed she was not physically able to have retention put in place. I hardly knew whether to take the appliances off and allow her to go for a time, or leave them on. I left them on for a short time; then

I removed the German silver and used retainers made from precious metals, and from that time she improved.

In another case wherein four clamp bands made of German silver were used for retention purposes on the first molars, the patient wore them for two years when the upper two were removed, and last year she developed enlarged submaxillary glands. The physician consulted with me regarding the appliances in the mouth. He said he really believed the metal had nothing to do with it, but "they would feel better if it was off." I removed the appliances. I saw the patient a few days ago. The glands are almost normal and everything going on nicely. That, of course, is not concluisve either.

As to the question of removing gold arches I do not believe this to be necessary. When kept absolutely clean without removing it is much more agreeable to the patient not to have them removed and religated in the mouth. The teeth can be thoroughly polished with suitably arranged wood sticks and pumice, without dislodging ligatures at all. If you use silver ligature wires I think you need not worry about polishing under the ligatures themselves.

Dr. Ottolengui. Why not?

Dr. Young. Because I do not think they will be very uncleanly. The ligature remains perfectly bright under the gum.

Dr. Ottolengui. If I understand the essayist at all, the danger is at the point of contact between the gold arch and the teeth. I can not see what the ligature has to do with it. If you keep the arch in contact with the teeth the ligature simply assists in holding it there, whether the ligature be sterile or not. The danger is at the point of contact between the arch and the tooth.

Dr. Grieves. The ligature is merely a mechanical force there. Strictly that.

Dr. Young. I take exception to that. With brass and gold, for a high and a low electric potential, I believe there is electrolytic action set up such as you do not get with gold or silver ligature wires.

Dr. Ottolengui. That may have a deleterious effect on the arch, but not on the teeth.

Dr. Young. I believe it does have an effect on the tooth.

Dr. Grieves. Silver in the table is classed rather near gold, and you have less action electrolytically with silver than with brass, because brass has zinc in it. Therefore, there would be more damage from the silver than from the brass wire over a gold arch.

Dr. Ottolengui. That is true, but when you use a silk ligature you have no such action at all. Is this caries caused by electrolytic action, or prevented by it? Let us understand your position.

Dr. Grieves. My idea is that caries is prevented entirely by the electrolytic action.

Dr. Ottolengui. Then the silver ligature is a bad one?

Dr. Grieves. Just so.

Dr. Young. That is what I want to get at. I have used silver ligatures only about two weeks. If there is any way to get light on the subject, I want to get it. As to the spring of the arches: I have found spring gold so much more elastic than German silver that I am using seventeen and eighteen gauge arches instead of sixteen. I have used ten per cent. of silver nitrate somewhat on teeth to prevent any bacterial growth, and so far have found it very beneficial, and no discoloration of enamel has resulted.

As to the patient failing to keep the teeth clean with appliances in the mouth, I do not agree with that statement. I have had many patients who have kept the teeth as clean as any one could desire. Sometimes the patient, and sometimes the nurse, has done it. For three years I have had my patients use not only one of these little single row tooth-brushes (roller brush, baby size), but four of them; one is used after each meal and one upon arising. They use them to brush around the appliances after using the regular tooth-brushes. These brushes are only made of soft bristles, and, if they are used two or three times a day, they become so soft that they are ineffective.

Dr. Ottolengui. Of course, I am perfectly delighted with this paper. I was delighted when Dr. Grieves accepted an invitation to write the paper, because I knew what its character would be. Dr. Pullen last year carried us up on the top of the mountain with reference to this matter, and now Dr. Grieves has carried us down into an abyss and left us there, and I want to ask him if he can not perhaps show us the path back?

No doubt much can be accomplished, as Dr. Young says, by use of the elbow and four tooth-brushes: one can not be used three times a day and be efficient for many days. Since dentists are using "any old tooth paste," etc., Why can not we do better than that? We have a particular place to cleanse, namely, where the arch comes in contact with the teeth. I believe we are safe enough with the D bands where they are cemented to place. Dr. Grieves admits they are safe enough when cemented. We have to deal more particularly with the more loosely applied metal parts—the arch in its contact with the tooth surfaces.

Can we have something to use with the brushes to act as a chemical cleanser? I think that such an agent would operate much better than just depending on brush work.

Dr. Bogue.

When Dr. Ottolengui tells us practically that a clean tooth does not decay he is very sound. When Dr. Young tells us about the electrolytic influence of gold upon brass, he is going into a garden where he is not acquainted. He speaks of a certain silk, which I have been using now for twenty-five years or longer. That silk will absorb in a very few hours injurious materials enough to be dangerous. He may sterilize it as much as he will, but if it stays in the mouth it will again become contaminated. These are elementary facts, and I am glad to have them brought up as Dr. Grieves has done. It should be a great advantage to us.

Dr. Rogers speaks of the brush devised by Dr. Clapp, with the single row of bristles. There is another brush which can be had with longer bristles at the further end.

The idea of absolute cleanliness does not seem to have wholly prevailed. The instruction given in past years to place bands on teeth without cement is all wrong. Disintegration has been noticed by our president, Dr. Hawley, as even taking place in teeth adjoining the banded one. Anything that produces and retains extraneous matter in contact with the tooth is injurious. You may have all the electrolytic action you like, and while it may kill bacteria, the fact remains that there are constant changes in the mouth; the deposits are constantly being made with every meal, and have just as constantly to be removed.

In regard to the silver wire, which Dr. Young has used but three weeks, a novice knows that a post set in the ground decays just at the ground margin—not where it is fully covered. The same thing is true of his wires. The salts of silver have a beneficial action in more places than one, but the surgeons have dropped silver nitrate pretty much altogether.

Another thing which is intensified by Dr. Grieves is the detrimental influence of ligature around every tooth. If that can possibly be avoided, it should be. Dr. Grieves, perhaps intentionally and perhaps otherwise, has given that idea a great deal of force.

Patients ask us almost daily, I suppose, what brush, what powder, what wash shall I use? "Dear Madame, are you in the habit of using soap and sand every day for the hands?" "No." "Why not?" "I keep the hands clean enough without." "Very well, keep the teeth clean without."

Dr. Pullen.

Dr. Bogue's caution about using silver ligatures does not appeal to me as having any value. I do not take much stock in the damage done by the elec-

trolytic action of the noble metals so long as we have at hand a prophylactic method of cleansing the teeth. Our greatest fault lies in not giving time enough to each patient to see that the teeth are kept clean. Dr. Young does not believe as I do in the frequent removal of appliances for prophylactic measures, yet I know that the mouths of his patients are exceptionally clean.

As the silver wire may be of some value in preference to the brass, I think it better to give it a trial before discarding it as useless.

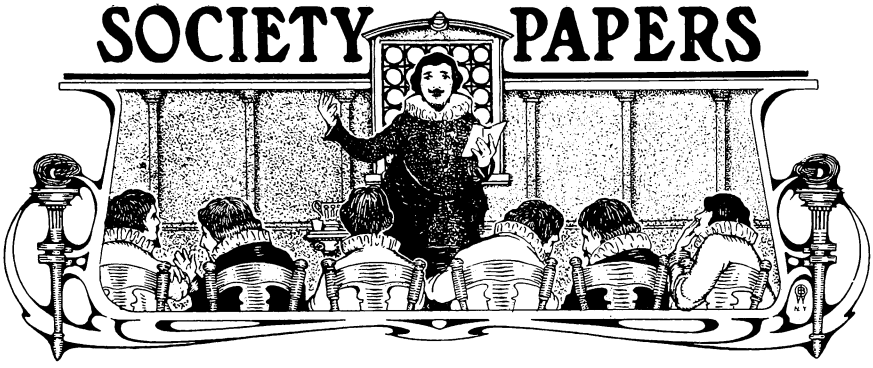
The paper of Dr. Grieves has been a source of great delight and instruction to me, and I am sure will appeal to many of you. The standpoint from which he has discussed the subject has been one from which I could not make any observations as I could not carry out the laboratory experiments in the work; it is along the line, however, suggested in my address of last year. As chairman of the Board of Censors I would like to ask Dr. Grieves to continue the work another year, as there is much of value still to be learned from just such exeriments as he has been making. The subject has been treated by Dr. Grieves from the chemical and pathological, as well as the bacteriological, standpoint. Dr. Hawley has studied the use of noble metals and German silver from the physical standpoint, testing the strength of the different wires, etc. Add to the experiments of these two gentlemen the clinical experience of those who have been using the noble metals and we must conclude that the noble metals for appliances are much preferable to the base metals. That tells the whole story in my estimation. The first consideration of a material to use in the mouth is the selection of one least affected by the oral fluids and which least affects the surfaces of the teeth. Dr. Grieves has pointed out admirably the results of the continued use of German silver. There is but one alternative, and my clinical experience adds additional proof in favor of the use of gold and platinum. In the physical aspects of the case the use of platinum as an alloy with gold raises the fusing point so that the flame of the blowpipe will not melt the alloy, and allows the greatest purity of the alloy. Iridio-platinum retaining wire can be used of smaller gauge than gold and platinum alloy, because of its greater rigidity. As has been said before, the cost is nothing. Arches may be used over again after being polished and sterilized, although I do not think it advisable.

I happened to be in Dr. Young's office some time ago, and I was pleased with his method of dealing with this question of brass ligatures. He called his assistant to the operating-room and requested her to remove all the brass ligatures, which had been kept in sealed tubes, and put them where he would never again find them; as from that time on he was not

going to use them. If we will all take that stand we will make rapid progress in the use of gold appliances.

The conformation of dental and orthodontic practice to the demands of the use of the noble metals is rapidly progressing, and the essayist is deserving of our thanks for comparing the base with the noble metals to the advantage of the latter.

Dr. Grieves. I only have a word of gratitude for the time given me. As to the continuance of the work, I feel if I could, as a result of my researches, be able to point a way to prevent enamel degeneration, I would be doing something that has never been done. We have had nothing yet for practical use in the mouth in dentistry which would control the gelatinous plaque, except elbow grease and thorough cleaning. I had in mind, while preparing the paper, the idea that orthodontists would have to do prophylactic work in their own offices, and not send it to some one else to do, because they would be too apt to put the appliances right back on again. I thank you, gentlemen.



Pathological Indications Controlling Procedures in Operative Dentistry.

By L. Ashley Faught.

Read before the Southern Dental Society of New Jersey.

In a passive way it is usually conceded that there is an intimate relation existing between those procedures strictly designated as operative dentistry, and the knowledge of dental pathology possessed by the operator. At the risk of appearing somewhat pedagogic, I shall in this short paper endeavor to develop and recall to you this relationship, because I fear that as dental operators we are apt to become, through daily routine, too much governed in what we do by the purely mechanical, and lose sight of the higher object of our service, the restoration to health and physiological service of the organs committed to our care.

Pathology, as you all know, deals with disease—dis-ease—the contra of ease. That which makes ease into dis-ease is the presence of an irritant. An irritant is that which irritates. The condition of harmony, part with part, is by it deranged to the degree of interfering with functional life. As dentists we are guided in pathology, in most instances, by unmistakable signs, which in proportion as they are comprehended, render our decisions unerring. They should be to us familiar acquaintances, with whose every peculiarity we are cognizant, and of whose every weakness we stand ready at all times to take proper advantage, for just in proportion as we do so will many of our procedures in operative dentistry be controlled, modified and possibly greatly improved. When a medical man approaches a new case, he is usually full of but one

idea, the history of the case, for he knows that the condition of things now existing are the result of causes which lead directly up to them; and he knows that whatever treatment he affords must be governed by the facts as they appear, and the knowledge and experience which he is able to apply to them. Before doing anything he seeks to know everything having any bearing upon the case. Why should it be otherwise with the dentist? The field of operation may be small, but it is a part of a body and subject to it. It is unwise to think only of a cavity of decay which needs to be filled, and jump to the conclusion that the filling material should be gold, porcelain, etc. The cavity of decay may be the sign of a far more involved condition, and should not be treated without a recognition and consideration of this condition, for upon its recognition will depend the success of the proposed operation, and more than all, the benefit to the patient.

Perhaps temperament, heredity, predisposition, present and past surroundings, habits, food, character of the oral secretions and numberless other relationships, should be considered in order to do our best for the case in hand. These and other questions, simple and complex, meet us daily, and are not to be solved by arbitrary rules.

Oral Secretions.

Perhaps the most simple, if not the most prominent, point of pathological contact by which dental caries is produced and influenced, and dental operations modified, is that involving a consideration of abnormal oral secretions, and the treatment of dental caries is rationally based upon the reasonably thorough appreciation which we have of such abnormal conditions. It is found that the saliva of those patients in which decay is most rapid is generally alkaline. When the saliva is of such character that it is stringy, can be drawn into thin ropes like spider webs, operations should not be attempted like those which can be done with perfect safety in mouths with thin, watery, acid saliva, or if done, must be most thorough, extra care and pains being taken to anticipate and even prevent recurrence of caries. An alkaline tooth wash, though usually looked upon as a valuable adjunct preparation, is not to be recommended to such patients with any view of eliminating future trouble, for acid producing bacteria develop best in an alkaline medium, and stop developing when the acidity rises slightly above one-half of one per cent. Far better would be the interdiction of starchy and saccharine foods.

The mere act of placing in position a good filling is mechanical, but should not be accomplished without thought of the controlling influences of pathology. The idea of most operators seems to be centered upon making mechanically a perfect operation; perfect, meaning to them, solidity, tightness, etc., using all the force and strength possible for

the accomplishment of this *much desired result.* There are, however, conditions which should not infrequently cause the inquiry, "What of the tooth?" and prompt looseness, rather than tightness and solidity, the preservation of the tooth and not the making of a filling being the desired result.

This same control is made where space has been obtained for the insertion of approximal and contour fillings. The operator is bound to recognize the pathological disturbances, and operate with such appropriate care as shall not only save the feelings of his patient at the time of the operation, but also as shall not leave the tooth weakened in its recuperative struggle to return to normal service. Where a recent attack of pericementitis has been aborted unfortunate results might attend work upon a tooth for a period long enough to fill with gold.

Operations During Youth.

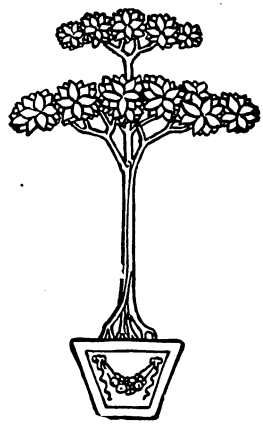
In operations upon the teeth of childhood and youth the study of pathology teaches that the teeth, at these periods of life, are possessed of certain characteristics which make them yield to decay in localities favoring the action of external destroying agents; and should point out in operative dentistry a different method of dealing with these teeth as compared with that utilizable when filling teeth of sound and robust maturity. Operations at this latter stage, when the tooth is perfectly consolidated, need not, to the same degree, consider the protection and conservation of the dental pulp, as is imperatively demanded before the tooth has reached its perfection of organization, and its maximum of density and resisting power. The importance of a living healthy pulp until the time when the tooth reaches its maximum of consideration can not be overestimated, and we should so modify our operations that in the desire to make ideal fillings we do not overstep the boundaries of prudence.

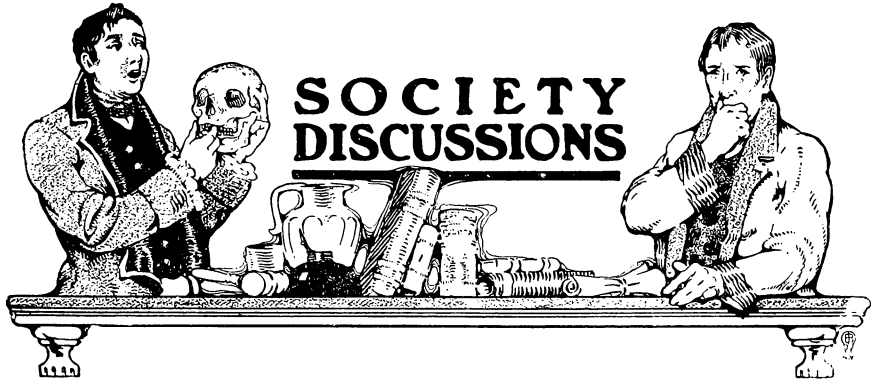
Prosthetics.

With the approach of old age comes the use of artificial dentures, particularly of partial dentures with clasp retention. Our knowledge of pathology is again called upon to control and modify our operative procedures. The teeth are now becoming fragile and recession of gum tissue is presenting exposures of tissue not before opened to destruction. The introduction of these foreign bodies into the oral cavity suggests the possibility of an irritant to the organs with which they come in contact, and even without any contactual relations with teeth, the saliva becomes modified in its reactions, its cleansing flow over the teeth is disturbed, and often a great breeding place for bacteria is established. Our operative procedure under such relations can not be the same as heretofore; we must take

cognizance of the new relations, and modify with educated judgment what is done to the remaining natural teeth.

In conclusion, may I be pardoned if for a moment, I deal with the pathological side from the operative standpoint, for I wish to say a word regarding the influence on disease by the choice which is made of filling material, and suggest that though gutta-percha in itself is a good preserver of tooth tissue, the quantity in any one mouth at any one time should not be large, nor should amalgam be allowed to supersede the use of tin, which, therapeutically, is one of the best metals known for preserving teeth from caries.





Second District Dental Society.

December Meeting.

A regular meeting of the Second District Dental Society of the State of New York was held on Monday evening, December 14, 1908, at the Kings County Medical Library Building, No. 1313 Bedford Avenue, Brooklyn, N. Y.

The president, Dr. Hillyer, occupied the chair, and called the meeting to order.

The secretary read the minutes of the last meeting, which were approved.

Dr. Croscup read resolutions of regret on the deaths of Dr. Samuel Waite and Dr. David Allen Morton.

The paper of the evening was read by Dr. Leuman M. Waugh, of Buffalo, his subject being "A Study of the Articulation of the Human Teeth from a Practical Standpoint." The paper was beautifully illustrated by lantern slides.

Dr. Henry C. Ferris. I want to thank Dr. Waugh for his careful and complete consideration of the subject from which we must all benefit.

My remarks will be directed toward the use of the Snow articulator, with bow attachment, to reestablish the uniformity of the curves of the condyle and the balance of the features.

The essayist has shown the dissimilarity of the curves conclusively, but does not offer an explanation. His inference is that we must recognize this condition in order to construct a denture that will be of the

greatest practical value. It is my belief that here is an opportunity for the prothodontist to restore the facial lines and produce the same curve on each side, as the oculist corrects a cross-eye or esophoria by forcing the muscles with prisms to perform their natural function.

The mandible is a creature of influence and is controlled by muscle tension even late in life.

FIG. 1. FIG. 2.

It is my belief that the prothodontist may bring about similarity of these curves by introducing dentures with a stronger occlusal contact upon the side that is abnormally curved. This could not be accomplished with one denture, but by gradually increasing the length of the molars the correction would occur.

This can be accomplished by an orthodontic operation in young subjects. Figs. 1 and 2 will illustrate the development of the ramus as a result of mechanical stimulation. This result was attained in two years, and serves to illustrate my contention. We all know that ill-fitting dentures frequently become serviceable after continued use. It is my belief

that the mandible adjusts itself to the denture. Why should not the patient benefit by scientific consideration, which would give a more normal balance of the features, the mouth, eyes, nose and, in fact, all the muscles influencing expression?

Discussion of Dr. Waugh's Paper.

Dr. W. B. Dunning, New York.

We shall never outgrow the necessity for keeping clearly in view the mechanical principles involved in the occlusion of the human teeth. Dr. Waugh's paper is timely and valuable, not because its subject is a novel one, but because it admirably presents a topic which can not be too carefully nor too often considered. One is reminded of the story of Mr. Bryant, in the days when he edited the *Evening Post*. A "Regular Subscriber" from the country, calling upon him one day, the general status and conduct of his paper were freely discussed. Referring to a certain editorial touching a pet reform which had especially gratified the rural gentleman, he dwelt at some length upon the vast influence for good which Mr. Bryant wielded, and concluded with a mild reproach that the subject of that editorial had not since been reopened. "Oh," said the editor, "I covered the ground, and it is now an old story; I see nothing further to add on that score." "You certainly did," was the reply, "and so have others done; but remember it is not enough to tell this to the people once or twice—it is the *reirritation* that counts!" However well comprehended may be the theory of normal occlusion, or what constitutes that condition, the practical application of our ideals in prosthetic operations is apt at best to be inadequate. We are, therefore, much indebted to Dr. Waugh for again bringing home the necessity for constantly studying this fairly well understood subject.

In the articulation of teeth for edentulous jaws, the essayist very properly emphasizes the importance of an appliance which shall accurately imitate the complication of movements afforded by the temporo-mandibular articulation. A contrivance which does not allow for the dip of the rami in accordance with each case, and the freedom of bilateral play secured by the comparatively distant positions of the condyle-paths (the glenoid fossæ) with all the looseness of these joints, can not form a guide for the anatomical placement of teeth. Yet the fact, I believe, must be confessed that in the majority of our laboratories, the common hinge-jointed articulator is still in general use.

In this crude but simple way the teeth are arranged more or less by guess, and any fault in the finished piece is remedied by the grinding away of the cusp or cusps that interfere with perfect closure. One of

our prominent practitioners in this work recently stated that it was his practice to grind away cusps at random, and that in fact the flatter the occlusal surfaces were made the better. That is the *practical* point of view, based upon success with old but now inadequate methods. It is to be hoped that Dr. Waugh's paper will start a wave of effort in the direction of insisting upon the accurate imitation of the natural apposition as the *only practical* ideal in the articulation of artificial teeth.

The problem of restoring correct occlusion is more constantly a ruling factor in "prosthetic" work than in the so-called "operative" procedures—to use these words in their arbitrary but accepted meanings. That is, a plate or bridge restores at once an extensive occlusal region which must be right at the outset, while the largest filling affects but a very limited opposed area, and, if not "too full," is generally supposed to be correct for all intents and purposes. The essayist very wisely urges the importance of cultivating a nice appreciation of the duty of the individual filling in being so shaped occlusally as to do its exact share of the work of mastication, but no more. In removing an overfulness of such a filling we have been too apt to relieve all contact, thereby concentrating the impact upon the remaining enamel walls, and so inviting disaster from fracture. Fortunately, in the use of cast inlays, we are now enabled to reproduce precisely in gold the occlusal planes recorded by the wax core. It should, therefore, become a standard requirement in good operative work to restore the normal masticating area of each tooth.

The student of the human chewing apparatus can never lose sight of the great mechanical advantage afforded by the maximum of occluding areas, accurately opposed to insure the perfect interplay of cusp and sulcus. Next to the relief of pain, this fundamental consideration should underlie his ideals and guide his efforts in the multitude of operations to be performed on the teeth, or in restoration of lost parts.

Dr. Crosbie. Mr. President and Gentlemen of the Second District Dental Society: I have been much interested in Dr. Waugh's paper and find it, like the porcupine, bristling with good points.

I wish to elaborate on what the essayist says about the overbite of the incisors and cuspids. The overbite, he says, is about one-third the length of their crowns. This is true of the nervous and bilious temperaments, but not of the lymphatic and sanguineous.

There is a marked overbite in the nervous and bilious temperaments. The dip of the arch in the compensating curve is a prominent feature, and interlocking of the cusps is strong. In the lymphatic and sanguineous

temperaments the overbite is short and there is a corresponding *lack* of cusp formation. The compensating curve is not very marked.

In the teeth which are characterized by long cusp formation the curves of excursion are correspondingly limited. The available area for mastication is, doubtless, as great as in teeth of flatter, broader cusp formation which permit wider mobility of the mandible. Where the cusps are long the fossæ are deep and the opposing cusps act in them as the pestle does in the mortar. The fossæ not only hold the food, but the inclines of the cusps surrounding them if spread out would cover a considerable area.

The curve of the occlusal plane, or the curve of the compensation, is determined by the length of overbite in the incisal region, which in turn is dependent upon the height to which the first molars have erupted. The development of the roots of the bicuspid ceases, and consequently the length of their roots is established when they reach occlusal contact, as determined by the height of the first molar.

The curve of the compensation should not be confounded with the curves of excursion of the mandible either laterally or antero-posteriorly. In each individual they conform to the curve of compensation. The curves of compensation seem to me to be quite as great a factor in determining these curves of excursion as the temporo-mandibular articulation.

The essayist concludes that the depth of the compensating curve is determined by the degree of inclination of the condyle-path. Here he seems to have the facts reversed, for a tooth in malocclusion may materially modify the curves of both antero-posterior and lateral excursions of the mandible, and consequently the inclination of the condyle-path. On the other hand, it is quite possible that the form of fossa and condyle, as well as the inclination of the condyle-path, depends upon the tooth form as influenced by temperament, and also the whole range of pathological possibilities which determine the position of the teeth.

I will quote a case mentioned by Dr. Cryer in support of my contention. The case was that of an aged person who had lost all but three teeth in the upper jaw and three in the lower. "They were not opposite to one another in normal occlusion. In order that the cutting or grinding surfaces of these teeth should come into occlusion, the left side of the jaw had to be carried forward, bringing the condyloid process of that side upon the articulating eminence, while the right side remained in a nearly normal position. Upon close examination of the condyle of the left side it was found to be flattened out, probably because of coming in contact with the *eminentia articularis,* thus moving the point of articulation forward, or jumping the bite."

While I appreciate that the instruments cited by the essayist may be very useful to the prosthodontist and produce beautiful results in restoring usefulness and symmetry, I am very doubtful of their usefulness to the orthodontist.

Dr. Van Woert. I am very much pleased to have heard Dr. say that Dr. Waugh mentioned that I had urged him for some time to come here and deal with sented with any paper. I am not in a position to discuss the paper in general, because I know practically nothing of orthodontia, and very little of prosthodontia; but I do think that what he has said about operative dentistry is worthy of very careful consideration. It was only through the introduction of the cast-gold filling that we fully realized the importance of accentuated occluding fillings.

One point especially that I think is very important is the pathological conditions which may follow malocclusion, due to faulty fillings. If I understand the subject correctly, as stated by some of the men in the West particularly, very many of the cases existing now of so-called pyorrhea, will be very largely eliminated if the fillings of the future are properly occluded, and I know of no better way by which that can be properly done, than with the cast filling. It seems to me the introduction of the cast filling opens up a very broad field. It is almost the dawn of a new era. I should like very much to study and make use of the appliance Dr. Waugh has presented to-night.

President Hillyer. Without entering into the discussion, I want to say that Dr. Waugh mentioned that I had urged him for some time to come here and deal with this subject. I felt that it was eminently proper that he should do so, coming as he does as a colleague of Dr. Snow, and I would say we have been experiencing a great deal of satisfaction in our college with this latest articulator in the hands of the seniors. I have lately had a conversation with Dr. Snow, and have made up my mind that it is time to do as he has done—put it into the hands of the freshmen. As the classes graduate, if they adhere to what they are taught, and I see no reason why they should depart from it, we will see a greater development along this line than in years gone by. I want to add my appreciation of Dr. Waugh's coming before us and presenting this excellent paper.

Dr. Hyatt. We all appreciate the subject which has been presented in such a pleasing and interesting manner, that all present, even if they be not interested directly in the subject, have been entertained. I would move that the members give a rising vote of thanks to the essayist.

The motion was unanimously carried.

Adjournment.

Central Dental Association of Northern New Jersey.

March Meeting.

The regular monthly meeting of the Central Dental Association of Northern New Jersey was held at Davis's parlors, Newark, N. J., on Monday, March 15, 1909. President Brinkman called the meeting to order.

On motion, a quorum being present, the roll call was dispensed with.

The secretary read the minutes of the last meeting, which were approved as read.

After the routine business had been disposed of the president then introduced Dr. P. B. McCullough, of Philadelphia, who read a paper entitled "The Vestibule Bow Lower Denture."

Discussion of Paper by Dr. McCullough.

Dr. Chayes, New York.

It seems appropriate that I should be asked to discuss this paper, because at the November meeting of this society I read a paper dealing with the same problem, but the method I advocated then for supplying posterior lower teeth does not, in any way, conform with the conception which Dr. McCullough has of the requirements of the space under consideration.

I will, at the outset, say that I consider the essayist a genius in his chosen profession. He has the faculty of taking infinite pains and, hence, the ability to produce perfect work; but I must also state that in this instance I believe he is laboring under a misapprehension as to the requirements of this space, and that I do not agree with him as to the quality and fitness of the essential features of the method which he advocates.

Successful lower posterior restorations can be produced only by a radical departure from the present-day methods, and the mere fact of changing the location or position of the usual lingual connection, to the startling vestibule bow, will make these cases neither fit, scientific, anatomically correct, nor physiologically comfortable so that, while the vestibule bow is certainly novel, it is a rather questionable departure.

I can not go deeply into the consideration of this paper without, to a certain extent, quoting from what I had to say on the subject some time ago:

"Artificial teeth are satisfactory in direct proportion to their being a close imitation of the lost dental members, not alone as regards the

obvious or visible similarity—though this is important enough—but as regards physical and actual relation to the teeth yet present and adjoining them, and those occluding with them, as well as to the soft tissues and other organs of the buccal cavity.

"Further, to be satisfactory, artificial teeth, particularly partial lower dentures, must not encroach upon the hard or soft tissue in any way; must exercise no traction or undue pressure; in other words, they must be physically so near the natural in construction and in action as to simulate as nearly as possible individual tooth motion." Individual tooth motion implies the independent action of individual teeth during the process of mastication, a most necessary quality of action made entirely impossible in this vestibule-bow piece presented by Dr. McCullough.

If, as the doctor states, the greatest strain is exerted in a vertical direction in the posterior portion of the mandible, then he has made no provision for taking up and dissipating this stress, and it will be communicated from the point of application to every part contributory to the support of the appliance. If the vertical stress exerted is equal to a compressor force of 1-75 or 1-100 of an inch, or, if, in other words, the soft tissues will allow of a compression or displacement to such an extent, there must, of necessity, be a corresponding pull or traction, or leverage, upon that tooth which holds the inlay, which contains that countersink which received that lug, which is actuated by that spring.

In preventing the riding back of the appliance during mastication we would necessarily have an undue amount of irritation in the location of this vestibule bow, and I doubt whether the former defect of riding back of the appliance is not to be preferred to the vicious effect this irritation might have in the end.

As presented to-night, the appliance lacks the quality of adjustment to conditions as they arise in the mouth. It would be impossible to cope with the problem of absorption of the alveolar ridge, because one would disturb the relations of the various parts to one another and to the adjoining tissue.

In the practical unilateral case which the doctor exhibited to-night he claims to have reversed the lever by bringing the vestibule bow attached to the artificial fixtures, around to the first molar on the opposite side of the mandible. As a matter of fact no such result has been accomplished, and a little elucidation on the point will bring this out very clearly. This contrivance is purely and simply a lever of the first class, the action of which is modified to a certain extent by the resiliency of the gum tissue and by the mobility of the mandible in turn determined by the muscular structures contributing to the temporomaxillary artic-

ulation. Now, in a lever of this kind, or of any kind, the power is to the weight in the inverse ratio of their arms; in other words, the longer the arm, the less power required to move the weight. This artificial fixture on one side, plus the vestibule bow attached rigidly thereto, makes the power arm; the fulcrum is at the point of the attachment of the vestibule bow to the molar band on the opposite side, and the weight or resistance is the molar carrying the band. It may be allowed that the fulcrum is not exactly at the point of the band and bow attachment, but rather somewhere on the vestibule tissue at the point where the bow piece fits the snuggest. This latter allowance would, however, not affect the problem materially as far as dissipating the deleterious consequences which the contrivance may have on the various parts involved.

We now come to the method of crowning advocated by Dr. McCullough. There is no doubt that he is entitled to great credit for giving us this method which enables us to conserve a large amount of tooth structure and a great many pulps, but I disagree with him when he states, unqualifiedly, and without exception, that the practice of covering occlusial surfaces of molars with gold crowns is based upon a misconception of the requirements for such cases. Innumerable instances arise where the dynamics involved will make his method of crowning far from perfect when the permanency is considered. It must be remembered that this criticism of his method holds good only where his crowns have been made supporting pieces for artificial fixtures.

The slight shoulder upon the tooth and the inlay joint which he thus obtains is of great advantage in cases where the latero-rotary stress is at a minimum, but must of necessity be considered a vulnerable point in those cases which seem to have the power of destroying any artificial fixtures weakened at any one point.

It is useless to attempt to overlook the fact that gold and platinum are ductile, malleable metals giving under stress and taking with them, while they give, whatever may be attached to them in a rigid manner.

A crown, therefore, consisting of a complete hood of platinum 36 gauge, upon which gold has been cast to the extent required to restore the contour and occlusion of the tooth to be crowned, has not the tendency to alter its shape under stress as the band of Dr. McCullough would have under the same circumstances, and there is not the danger in the former method of exposing numerous fine lines between the band and the tooth on the occlusal surface which would obtain in the banding method and be, of course, a great disadvantage.

To revert to the hood method, if the gingival end of the platinum hood, or, rather, if that part of the hood designed to go beneath the free

margin of the gum, is left free of any gold, the operator will obtain a crown which can be burnished to the root with absolute precision, and without any great trouble, thus reducing the possibilities for gingival irritation.

I think Dr. McCullough's method is to be preferred in cases where the pulp is as yet a factor to be considered and reckoned with in the nutrition and development of the tooth. Where the patient has reached an age at which the services of the pulp may safely be dispensed with the complete hood method is, for reasons of strength and permanency, to be preferred.

A great deal might be said in reference to pulp extirpation and crowning, both for and against the procedure, but the doctor's paper does not call for any further elucidation or discussion on that particular point.

Dr. McCullough's method of placing the split pin outside instead of inside the root, is a great advantage, and certainly simplifies this sort of work. It makes it safer, both for patient and operator, and is quite as durable (if not more so) as the sinking of a tube into a root, which latter procedure often endangers the structural integrity of the root to the extent of permanent disability.

I want to thank the doctor for the opportunity he gave me of seeing and discussing some of his work, and I thank the president for extending to me the courtesy of taking part in the discussion of the paper read here to-night.

Dr. Hillyer, Brooklyn.

This occasion has illustrated to me the inability to get anything out of a paper from reading it in the journal, commensurate with what one may get out of the same paper by hearing it at a meeting. I have seen a copy of this paper, and last evening I went into my office and tried to figure it out, and I confess that when I got through I knew very little about it, because until you see specimens you hardly know what a paper means, and even with illustrations, it does not appear in the same way as when it is demonstrated.

As to the actual merits of the case as compared with the methods of the last speaker I can not compare them, because I am not familiar enough with Dr. Chayes's methods to know just wherein that difference lies, but I would like to ask Dr. McCullough if he finds it necessary to make that labial band as broad as indicated in the case shown. I take it that strength is absolutely necessary, but it seems that it might be obtained by means of a heavy wire of the clasp variety that will give the same spring and the same strength.

As to the matter of the piston and countersunk cavity, that, I should think, would be a good locking and would necessarily require something on the labial side in order to hold it in its position; but I should be rather adverse to the presence of that labial band unless it was absolutely necessary. In the second instance, where the crown over the first molar is in position, I should hardly think that necessary in order to get the desired result.

. . . . . .

Dr. McCullough. I do not understand you. If the first molar was in position?

Dr. Hillyer. Yes; if it were there to hold it in proper relation, it seems to me that the labial band would hardly be necessary; I should think the lingual connecting bar would be just as good and would be out of sight.

As far as the shaping of the roots is concerned and the taking of impressions I have found the greatest satisfaction in taking such impressions in the Detroit modelling compound, with the little trays provided in the system devised by Dr. Roche. There you get a cement model that is so hard you can scarcely crack it. You may get the same results with hand presssure, but I never felt as much satisfaction in that way as under Dr. Roche's method. The same results can be obtained with amalgam as was demonstrated by Dr. Van Woert at the last meeting of the Second District Society.

But it seems to me I could hardly, with the little cone-shaped paper, get the pressure of cement I should like and the accurate model necessary in a case of that sort, in order to get the perfect results that Dr. McCullough desires and probably does get. I would feel better satisfied with the other means.

As to the split pin as an anchorage I should say that is very good, and I feel that in seeing that anchorage I have been repaid for making a trip from Brooklyn, for we are always looking for anchorages for removable bridges, and this I consider a very, very excellent one.

Dr. Samuel Doskow, New York. Whenever I have had occasion to listen to Dr. McCullough I have invariably agreed with him, but when, after leaving, I began to reason to myself, I have had to use methods altogether different from his. However, after experimenting several times, I would realize the futility of my methods and adopt his. I suppose it will be so with the matter presented to-night. When I received the copy of the paper, and even later when I saw the models, before coming to the meeting, I could not convince myself that the doctor was right, but on reconsideration,

while listening to the objections made, especially those of Dr. Chayes, I am inclined to believe that after all Dr. McCullough is right.

One objection Dr. Chayes raises is that it fixes the two ends of the plate absolutely in the mouth and does not permit of individual play. If Dr. Chayes will remember that plate rests against living tissue and living tissue in itself permits of play, and the difference between the resistance of the living tissue and the springiness of that band, which surrounds the alveolar process on the labial side is so great that it is bound to permit all the play necessary to maintain that plate in proper position and give the desired masticating strength. But that is only assumed by me, I am not able to prove it from practice.

I have tried the system of cutting down the teeth with the copper shells shown. The telescopic band I have made in two ways. In one case, by making a cement model and fitting a very thin platinum band, covering it with wax, which is carved to the desired shape and cast. In another, by molding the wax over the model, carving and casting; and in both cases I secured excellent results.

We know, as a matter of fact, that the enamel of a tooth is its insulating membrane, a covering of asbestos, as it were, to protect the pulp from the irritation of heat and cold, and the less of that we remove the longer we preserve the life of the tooth. If you remove the cusp of a tooth and cut it down to the dentine and then place the gold directly against that you will find sooner or later that the pulp of that tooth will be involved, and the tooth must be devitalized in the end. In this way, even if decay should occur later, recourse can be had to filling, especially if the tooth is watched by the dentist carefully. A filling of not very great depth could be inserted and still preserve the life of that tooth. There may be statements made that in cases of this kind where most of the patients are of advanced age, that the pulp of the tooth is not of great importance. It may be so, but to sacrifice a living pulp in a tooth that is firmly fixed in the mouth and then, especially in a second or third molar, to run the risk of the removal of that pulp and the subsequent mistakes in the treatment that may follow, is so hazardous that I think we are justified in preserving the life of the tooth as long as possible.

A word or two about the crowning of teeth in general as has been demonstrated here by the removable cuspid in connection with the plate. I have used that system of crowning teeth for the last five years; that is, that system of preparing the roots and making the band. The method is very simple. The objection has been raised in a number of cases that it is very difficult to make, and that the average man can not do it. I do not consider myself above the average; I know it takes me a long

while to learn a thing, especially when I have to make a mechanical appliance, but I can make this appliance in a shorter time than it will take any man to make a Richmond crown, and I can get better results, because I have perfect control of the end of the root after I have taken an impression and made a cement model, for I am working on the model and not on the root of the tooth. I do not have to work on any living tissue, nor do I have to work in a blind area. When fitting a band around a root you are absolutely in the dark and do not know where that band is going to, especially in the bicuspids, and even in cuspids where the root is tapering, and the further you go with the band on the gum the further you are away from the root, so that you are creating a source of irritation which is very undesirable.

Dr. Sanger. I have listened to the paper of the evening, and to those who have discussed it, with a great deal of pleasure.

The proof of the pudding is in the eating; I believe the essayist is a truthful man, and when he says he has made these plates, and that they work perfectly in the mouth, what is the use of arguing about whether they will work or not? Dr. McCullough says they serve, that he has them in the mouth, and that they continue satisfactory, and I think that is proof enough that the idea is practicable.

I think that Dr. McCullough's idea of the telescopic crown is a modification of the Griswold patent which we had presented to us several years ago.

I am very much obliged to Dr. McCullough for his very clear presentation of the subject. The idea of these shells for grinding down teeth is entirely new to me, and I have been very much interested in it, and hope to be able to put it in practice. That suggestion alone is sufficient payment for my coming here, and I thank Dr. McCullough for it very much.

Dr. McCullough. I appreciate the favorable discussion, and am no less pleased with the adverse opinions that have been expressed against my interpretation of the mechanical problems involved in the subject before us.

To answer what has been stated would require an elaboration on my part of that which is given in the paper.

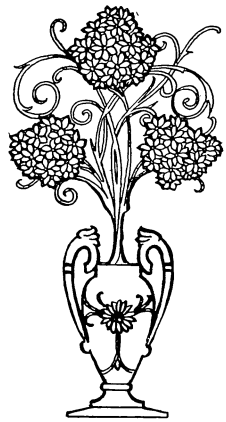
I believe that the labial bow, as here used, is new; by actual test in practice in my hands it has proved superior to the lingual bow. The different attachments given, the preparation of the natural roots and

the natural crowns, are all departures in technic differing from methods taught, and are given after tests in practice have proven their worth.

On motion, a vote of thanks was extended to Dr. McCullough for his very able paper.

Dr. Charles A. Meeker then introduced Dr. Sterling Wines, of Boston, who proceeded to explain the application of hypnotism to dentistry, and to give a demonstration of its powers.

On motion, a vote of thanks was extended to Dr. Wines.



EDITORIAL

The Future of Metal Casting in Relation to Dental Art.

While all dentists are employing a casting machine of some sort, to some extent, in their practice, few indeed realize the tremendous revolution in dental technique through which we are passing. Already many modes of work have been completely changed, yet one who but tries to peep into the future must see that, as yet, we have but an inkling of the possibilities. We are in a transition period. The art of metal casting, in its application to dentistry, is but in its infancy. Much has been accomplished, yet many problems are yet to be solved. These would best be studied by a harmonious coworking of all who are interested in this new art.

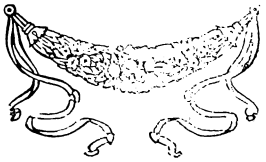
Problems Not yet Finally Solved.

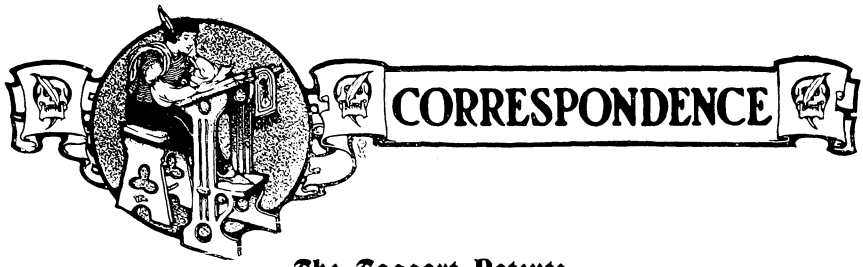
In order to do perfect work we must have absolutely reliable materials—materials which will constantly achieve definite results if employed in a definite way. A few of these may be enumerated. For making a wax inlay the Taggart wax thus far is the best that has been offered. Yet this perhaps could be improved. It is of the correct hardness for carving, and resists the heat of the oral cavity, but it is not easy to properly soften it. Moreover, it could be

offered to the dentist in much more convenient form than in the shape of sticks; the inlay wax should be sold in the form of marbles, half marbles and cones, of appropriate size. There is no perfect investment, as yet, on the market, and apparently two styles are required: one with which to invest wax models, and another which may be used for making casts of mouth parts. The latter should set hard enough to be readily removed from plaster impressions, so that saddles, clasps, etc., could be fashioned in wax direct to the cast, and wax and cast then invested, so that the metal could be cast direct against a replica of the mouth. No material yet offered is entirely satisfactory for this. An ideal wax for prosthetic work is sadly needed; this should have the qualities of the Taggart wax, but should come in varying thicknesses, to match the metal plate with which we have been accustomed to work; thus one should have wax from which he might cast a plate of 28 gauge, carrying clasps of 24 or 26 gauge. It would also be very convenient to have wax in the form of wire, matching standard wire gauges.

In connection with crown and bridge work, apparently a special form of porcelain tooth and facing is required. Such teeth should be so fashioned that they would require little grinding; thus, in case of fracture after being cemented to a cast base, a repair could be easily made.

We hope during the next year to publish many articles on the technique of casting, but we are pleased to announce at once a series, by Dr. Hart J. Goslee, dealing with the casting methods in their application to crown and bridge work.





The Taggart Patents.

Editor ITEMS OF INTEREST:

In regard to the letter in the May issue of ITEMS OF INTEREST, signed by Edmund Noyes, a few stray thoughts may not be amiss. It is an undisputed fact that all men deserve some fitting reward for their toil, whether it be along the lines of invention or otherwise. The question at present seems to be whether Dr. Taggart shall say what his reward should be, stated in terms of dollars, or whether he shall depend upon the generosity of the dental profession for his compensation. Judging from men's speech, the supreme idea in their minds is that of justice; but judging from their acts, and from a close observation of their motives, one is constrained to believe that the chief characteristic of the human race is that of selfishness. We still pretend to believe in the application of the golden rule, "Do unto others as you would they should do unto you," when we expect leniency from an opponent, but seldom when the case is reversed, and leniency is expected from us. The statement of the matter relative to Dr. Taggart cannot be made clearer than it is in the letter referred to in this magazine.

But, as a spike is driven into place more easily by alternate blows of hammers wielded by two persons, so a man's position may be better defended by several minds acting in unison than by one acting alone; therefore I have proceeded to swing my tack-hammer somewhat mildly from the point of my pen in defense of a man's rights.

Words are very light and transient; they may mean one or many things; they are wafted away on the breeze, like the bubbles blown from the small boy's pipe; they are liable to several interpretations; they may express high approbation of a man, or his efforts, while veiling contempt and contumely; therefore, they are of slight value to one who has invented a machine, or worked out a new process for the benefit of mankind. The substantial appreciation of a person's efforts, in the present stage of society, can be shown only by a money value.

For instance, if a man writes a book, some of his friends mercilessly criticize it, not because of what it contains, but because the author has certain mannerisms which excite their antipathy; they avoid him as one whose mental state is approaching disintegration. Now, manifestly, it would be useless to give the book away, for it would be accepted, if not read, and the writer would be as much in the dark about the true merit of his work as he was before. Consequently, if he wishes to obtain an unbiased opinion, relative to his literary effort, he is obliged to put

a price on his book, and appeal to the public for appreciation. If a demand is created for the book, and numerous copies are sold, the writer is justified in believing that his work is in some degree meritorious.

The same kind of reasoning applies to an inventor of a patent or of a process. Therefore, Dr. Taggart seems to be warranted in adopting any method, which appears to be reasonable to him, to defend his rights and protect his process. A very superficial observer knows that members of the dental profession are no further advanced on the route of human progress than the rest of our race; so it follows that selfishness is as much an attribute of their individualities as it is of others. Considering this aspect of humanity, Dr. Taggart would be very unwise to trust to anybody's generosity.

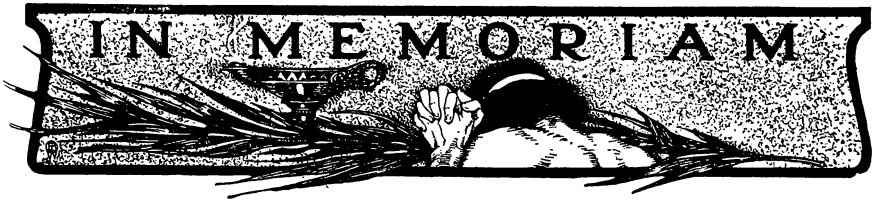
Furthermore, the cost of any article, patent or process, is paid for by the consumer, or the last person to pay; we all know that the consumer, in relation to the dentist, is his patient. In view of this fact what does it matter if Dr. Taggart should make a few thousand dollars as a reward for his study, and the benefit he confers on the profession and the public? The chances are that he never will be overpaid, and certainly purchasers of his machine would not have a true appreciation of its value if its price should be reduced one-half. Dr. Taggart seems to be pursuing the proper course. He alone knows the time required, the sustained effort, the repeated failures he must have met, and the weary trials endured, before success was finally achieved. For the dental profession to request the privilege of saying what the price of his machine should be would be equal to dentists permitting their patients to tell them the value of their services.

Many factors enter into the cost of a finished article, which are unknown to the purchaser; all that he sees is the result of what has been done; he can have very little knowledge of the innumerable details that go to make the completed whole. It therefore behooves those who wish to purchase one of Dr. Taggart's machines to pay the price asked; thereby removing the suspicion of any obligation to the inventor that might savor of charity on account of a reduced price. So far as the ethics of such cases are concerned, probably inventors and purchasers of their inventions will never agree, as the point of view depends largely upon which position one occupies.

I would say in conclusion that an ethical nature, like a polite nature, is innate. Such a nature can not be created by having one sign a code of ethics, of which he forgets the significance as soon as he signs it, any more than a fraternal nature can be given to one by making him a member of a fraternal organization. Those qualities are inborn, and can not be conveyed to us by the signing of documents, nor through fallacious notions of ethics.

W. H. DUDDY, D.D.S.

Boston, Mass.



Dr. A. W. Harlan.

WHEREAS: Through the death of Dr. A. W. Harlan, the Odontological Society of Chicago has lost its founder and a former president; one who had been most actively connected with the society for twenty-five years, whose vigorous personality won for him the respect, admiration and love of his colleagues; therefore, be it

Resolved, That the members of the Odontological Society of Chicago express their profound sorrow at the loss of their associate, and extend heartfelt sympathy to the bereaved family. And, be it further

Resolved, That these resolutions be spread upon the minutes of the society, that a copy be furnished to the dental press for publication, and that a further copy be transmitted to the family of the deceased.

J. W. WASSALL,
C. N. JOHNSON,
W. V. B. AMES.

Resolutions Passed at the A. D. S. E. Meeting

At Weisbaden, April 12, 1909.

"WHEREAS, through the sequelæ of an unfortunate accident, there has been removed from our midst our colaborer and respected friend and member, Dr. Alison W. Harlan, of New York, U. S. A.; be it

"*Resolved,* That, in his death there has been taken from us, at the zenith of his usefulness, one of our most regular contributors and efficient workers, a staunch friend of science and one of the brightest and most companionable members of our profession.

"*Resolved,* That in his demise, dentistry has lost one of its most able instructors and the younger members of our profession one of their most reliable guides and truest friends; and be it

"*Resolved,* That the American Dental Society of Europe in the death of our brother and colleague hereby deplore its irreparable loss, and respectfully tenders its sympathy to his widow and children in their sad bereavement, and that this expression of our feeling be conveyed to them by our secretary, and that a copy of the same be inscribed in the minutes of our deliberations as a permanent record of our love and respect for our departed brother."

(Signed) W. MITCHELL,
I. B. DAVENPORT,
W. M. GRISWOLD.

SOCIETY ANNOUNCEMENTS

National Society Meetings.

National Association of Dental Faculties, Old Point Comfort, Va., August 2, 3, 4, 1909.

National Association Dental Examiners, Old Point Comfort, Va., August 2, 3, 4, 1909.

State Society Meetings.

Colorado State Dental Association, Colorado Springs, Col., July 12, 13, 14, 1909.

Florida State Dental Society, Ocala, Fla., June 17, 18, 19, 1909.

Georgia State Dental Society, Cumberland Island, June 1, 2, 3, 1909.

Iowa State Dental Society, Des Moines, Ia., May 4, 5, 6, 1909.

Indiana State Dental Association, Indianapolis, Ind., June 29, 30, July 1, 1909.

Maine Dental Society, Portland, Me., June 24, 25, 26, 1909.

Massachusetts Dental Society, Boston, Mass., June 9, 10, 11, 1909.

Michigan State Dental Society, Kalamazoo, Mich., June 29, 30, July 1, 1909.

Minnesota State Dental Association, Lake Minnetonka, Minneapolis, Minn., June 22, 23, 24, 1909.

New Jersey State Dental Society, Asbury Park, July 22, 23, 24, 1909.

New Mexico Dental Society, Albuquerque, N. M., June 17, 18, 1909.

North Carolina State Dental Society, Asheville, N. C., June 23 to 26, 1909.

Ohio State Dental Society, Columbus, O., December 7, 8, 9, 1909.

Oklahoma State Dental Society, Oklahoma City, Okla., June 3, 4, 5, 1909.

Oregon State Dental Association, Portland, Ore., July 12, 13, 14, 1909.

Pennsylvania State Dental Society, Pittsburg, Pa., June 29, 30, July 1, 1909.

South Dakota State Dental Society, Huron, S. Dak., June 29, 30, July 1, 1909.

Texas State Dental Association, Waco, Texas, June 10, 11, 12, 1909.

Utah State Dental Society, Logan, Utah, latter part of June or first part of July.

Virginia State Dental Association, Chase City, Va., June 21, 22 23, 1909.

Washington State Dental Society, Seattle, Wash., July 15, 16, 17, 1909.

West Virginia State Dental Society, Wheeling, W. Va., October 13, 14, 15, 1909.

Wisconsin State Dental Society, Milwaukee, Wis., July 13, 14, 15,

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California State Dental Association.
Alumni Association Dental Department, University of California.

The California State Dental Association and the Alumni Association, Dental Department, University of California, will hold a joint session July 6, 7 and 8, 1909, in San Francisco.

C. E. Post, Secretary.

The California State Dental Association and the Alumni Association, College of Dentistry, University of California, have secured the services of Dr. John Q. Byram, of Indianapolis, and Dr. Weston A. Price, of Cleveland, for their joint session to be held on July 6, 7, and 8, at the College of Dentistry, San Francisco.

The presence of these men is a guarantee of a first-class meeting.

Indiana State Dental Association.

The fifty-first annual meeting of the Indiana State Dental Association will be held at Indianapolis June 29-30, and July 1.

Plans are being perfected to make this the greatest strictly State meeting ever held in the history of our society.

OTTO U. KING, Secretary.

Huntington, Ind.

West Virginia State Board of Dental Examiners.

The West Virginia State Board of Dental Examiners will hold their next meeting at Charleston, W. Va., June 9, 10 and 11. For further information address, J. F. BUTTS, Secretary.

Charleston, W. Va.

Pennsylvania State Dental Society.

The forty-first annual meeting of the Pennsylvania State Dental Society will convene at Pittsburg, Hotel Schenley, June 29, 30, July 1, 1909. A very interesting programme is promised.

LUTHER M. WEAVER, Recording Secretary.

Idaho State Dental Board.

The Idaho State Dental Board will meet in Boise, Idaho, June 21-23, 1909. Applicants must bring operating instruments and engine.

E. L. BURNS, Secretary.

Boise, Idaho.

Virginia State Dental Association.

On account of the Mecklenburg having been destroyed by fire the place of meeting of the Virginia State Dental Association has been changed to the Chamberlain, Fortress Monroe, Va., July 21, 22, 23, 1909.

W. H. PEARSON, Corresponding Secretary.

Board of Dental Examiners of the District of Columbia.

The next semi-annual examination of the Board of Dental Examiners of the District of Columbia will be held at the George Washington University, July 1, 2 and 3, 1909. All applications for examination must be accompanied by a fee of $10, and filed with the secretary by June 22, 1909. For further information address

STARR PARSONS, M.D., D.D.S.
1309 L Street, N. W., Washington, D. C.

Kansas State Board of Dental Examiners.

The Kansas State Board of Dental Examiners will hold a meeting for the examination of applicants for license to practice dentistry in Kansas, beginning Tuesday morning at 9 o'clock, June 15, and continuing until Saturday the 19th.

All applications must be in the hands of the secretary by June 10. The examination fee is $25. Only graduates of reputable schools, or those having practiced five consecutive years in another State, are eligible for examination.

The meeting will be held at Topeka, Kan., in the Roof Garden of the National Hotel.

For further information or blanks write the secretary.

G. F. AMBROSE, President,
Eldorado, Kan.
F. O. HETRICK, Secretary,
Ottawa, Kan.

Florida State Board of Dental Examiners.

The next annual meeting of the Florida State Board of Dental Examiners will be held in Ocala, Fla., June 14, 1909, 9 a. m.

Applicants for certificates to practice dentistry in this State will be required to exhibit diplomas from reputable dental colleges, and take examination, both theoretical and practical. Theoretical will embrace all subjects taught in the dental colleges; practical examination on both operative and prosthetic dentistry. Board will furnish head-rests and blowpipe. Applicants must furnish photograph with application. Any further information will be furnished on application.

W. G. MASON, Secretary.
Tampa, Fla.

Fifth International Dental Congress.

Berlin, Germany. August 23 to 28, 1909.

Official Communication from the Committee of Organization.

Invitation.

To our colleagues of all nationalities we hereby extend a hearty invitation to participate in the Fifth International Dental Congress, to be held in Berlin, August 23 to 28, 1909, in the Reichstag Building.

When at St. Louis in the year 1904 the highly appreciated and respected Professor W. D. Miller, as president of the Central-Verein Deutscher Zahnärzte, invited the congress to meet in Berlin in 1909, the German dentists were greatly pleased at the unanimous acceptance of their invitation.

The congress will be coincident with the fiftieth anniversary of the Central-Verein Deutscher Zahnärzte. The united German dental profession is therefore preparing to worthily celebrate this occasion, and to make the theoretical and practical results of this congress stand out as a landmark in the development of dental science.

Colleagues of all nations will combine, and in friendly rivalry giving and taking, learning and teaching, demonstrate to the educated world what great progress the science of dentistry has made in recent years!

Through well-attended meetings, at which representatives of all nations will discuss theoretical and practical problems, dentistry will prove itself an independent science, worthy of being regarded as one of the numerous intellectual achievements of mankind.

The German Organization Committee, selected by the F. D. I., the Central-Verein, and the Vereinsbund, have completed their preparations, and now appeal to all colleagues, both at home and abroad, for their esteemed support.

The Reichstag Building offers ample space for the meetings of the congress, which is divided into twelve sections. The Berlin Local Committee will do everything possible to entertain the visitors in the German metropolis during the time not ocupied by more serious pursuits.

An International Dental Exhibition, to which the members are earnestly invited to contribute, will, in the widest sense, demonstrate the progress of our profession.

Honorary presidents of the congress are: Geheimer Medizinalrat Prof. Dr. Waldeyer; Wirklicher Geh. Ober-Reg-Rat, Ministerialdirektor Dr. Naumann; Geheimer Ober-Medizinalrat, Prof. Dr. Kirchner, and Geheimer Ober-Medicinalrat Dr. Dietrich of the Kultusministerium.

An Honorary Committee is also to be chosen.

The German Imperial Government has decided that the governments of the nations represented shall be officially informed of the meeting of the International Dental Congress in Berlin.

Besides the meetings of the individual sections, the congress will hold two general sessions. At these meetings time will be found not only for lectures and demonstrations, but also for the discussion of sub-

jects of general interest proposed by the chairmen of the sections. All progress in scientific, technical, and operative dentistry, as well as the subject and development of dental hygiene, will be presented by the ablest authorities.

A meeting of the F. D. I. will take place at the beginning and at the end of the congress.

Colleagues—With your united support, may the great work succeed! The invitation is most heartily given by your German colleagues. With our united strength, let us guide our profession to still greater success, for the honor of science, for the benefit of mankind.

WALKOFF, President,
SCHAEFFER-STUCKERT, Secretary-General,
Committee of Organization of the Fifth International Dental Congress.

Communication from the Berlin Local Committee.

General Chairman, PROFESSFR GUTTMANN, 24 Kurfürstendamm, Berlin.

The object of the Berlin Local Committee is to make the sojourn of those visiting the congress as agreeable as possible.

In order to fully meet all requirements, the committee has decided to send out a list of questions relating to hotel accommodations, seats at the banquets and entertainments, and excursions and tours to German cities and universities. By returning the questions fully answered, at an early date, the Berlin Local Committee will be able fairly accurately to judge of the number of those intending to be present at the different entertainments, etc. This will facilitate the work of the committee and also give an opportunity of considering individual wishes.

Anyone desiring special information regarding matters within the province of the Local Committee should communicate with the general chairman, Professor Guttmann, 24 Kurfürstendamm, Berlin, or with the chairman of one of the sub-committees. So far, the following of these have been formed.

(1) Entertainment Committee—Chairman, Professor Guttmann, 24 Kurfürstendamm, Berlin.

(2) Business Committee—Chairman, Dr. Robert Richter, 23 Victoriastr., Berlin.

(3) Committee on Inspection of the Scientific Institutions—Chairman, Dr. Ritter, 94 Königgrätzerstr., Berlin.

(4) Press Committee—Chairman, Markuse, 12-13 Nettelbeckstr., Berlin.

(5) Reception Committee—Chairman, Willmer, Gr. Lichterfelde, Jungfernstieg 3.

(6) Ladies' Committee—Chairman, Gutmann, 71 Alexanderstr., Berlin.

(7) Committee to procure the necessary apparatus for Lectures and Demonstrations—Chairman, H. J. Mamlok, 143 Kurfürstenstr., Berlin.

(8) Committee on Hotels and Accommodations—Chairman, Pursche, 30 Rankestr., Berlin.

The Local Committee has made an arrangement with the Hamburg-American Packet Co., by which participants in the congress will receive,

except during the height of the season, a considerable reduction of rates.

The Local Committee has been able to obtain the aid of a number of colleagues living in the larger cities of Germany, who are prepared to give advice and help to strangers visiting the congress. A list of these colleagues will be sent with the question blank.

Interpreters, distinguished by a special badge, who will be pleased to give their services, will be found in the office of the congress, at the meetings, entertainments, and on the excursions.

The official reception will be held in the Reichstag building. This magnificent and impressive structure is, above all others, a worthy meeting-place for serious scientific conventions. There is a sufficient number of rooms in this building for all sections to hold meetings simultaneously. The office will be established here several weeks before the beginning of the congress. A post-office and telephone and telegraph stations in the building will be at the disposal of participants in the congress.

The Berlin Local Committee has undertaken to entertain the visitors during the congress. Arrangements have been made, giving visitors, during the time of the congress, free admission to the Zoological Garden and its concerts, as well as to the Landes-Ausstellungs Park and the Annual Berlin Art Exhibition.

The City Council of Berlin has graciously promised a reception in the City Hall, on Monday evening, August 23.

A banquet will be held on August 24, in the hall of the Zoological Garden, to celebrate the fiftieth anniversary of the foundation of the Central-Verein Deutscher Zahnärtze.

For Wednesday, August 25, no special entertainment has been provided, in order to allow each visitor to spend an evening as he prefers; nevertheless, a part of the Landes-Ausstellungspark (concert garden) will be specially reserved as a meeting-place for the participants in the congress.

Thursday evening, August 26, the official banquet of the congress, followed by a ball, will be held in the Landes-Ausstellungspark.

For Friday, August 27, afternoon and evening, the colleagues of Berlin and the Province of Brandenburg invite the participants in the congress to be their guests. In the afternoon a fleet of steamers, specially chartered, will make a trip through the scenically beautiful Havel Lakes. In the evening a banquet will be held at the Schwedischen Pavillon in Wannsee.

On Saturday, August 28, an Abschiedstrunk (parting cup) takes place on the Terrassen am Halensee.

Excursions will be arranged to the environs of Berlin, as well as to various German cities and universities.

The Local Committee will arrange that places and buildings of interest, as well as scientific institutions, can be visited and inspected with competent guides.

During the meetings the committee will arrange for the entertainment of the ladies accompanying the members of the congress.

All communications and items of interest will appear in the Daily Journal of the congress, edited by Dr. Konrad Cohn. The perusal of this journal is therefore strongly recommended.

To the social functions, only those having tickets will be admitted. The price of these is 12 marks.

We hereby beg all colleagues to acquaint us *as early as possible* with their intention to visit the congress, and to send us a notification.

It is especially wished to obtain a list of lectures and demonstrations, also the number of visitors, at an early date, we beg that all notifications be sent at your very earliest convenience.

All questions regarding the journey and accommodations should be sent to the president of the Berlin Local Committee, Professor Guttmann, Berlin, Kurfürstendamm 24.

All applications for membership should be forwarded to the National Committee in your own country, or direct to the secretary-general, Schaeffer-Stuckert, D.D.S., Kettenhofweg 29, Frankfurt a. M.

All inquiries regarding the exhibition should be sent to Prof. Dr. Dieck, Potsdamerstr., 113, Villa 3, Berlin.

Further information will be gladly given by the president, the secretary-general, or the secretary, Dr. Konrad Cohn, Potsdamerstr. 46, Berlin.

SCHAEFFER-S[illegible]T, Secretary-General,
Committee of Org[illegible]tion of the Fifth International
Dental Cong[illegible]ess.